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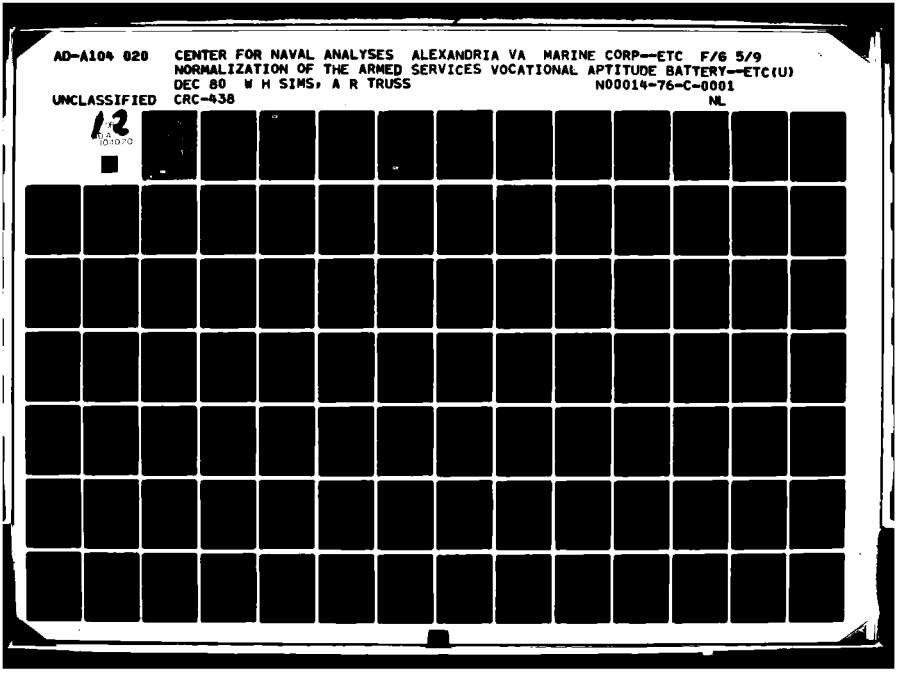

CRC-438 December 1980

LEVEL II

NORMALIZATION OF THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB) FORMS 8, 9, AND 10 USING A SAMPLE OF SERVICE RECRUITS.

William H. Sims
Ann R. Truss

Research Contribution

N00014-76-C-0001

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All branches of the Armed Services use the Armed Services Vocational Aptitude Battery (ASVAB) to measure the mental aptitudes of prospective recruits. New forms of ASVAB are introduced periodically. Before new forms are introduced they must be normalized (i.e., the proper relationship must be established between the number of questions answered correctly and a standard score scale). This process ensures that a certain score on the new forms represents the same ability level as that same score on previous forms of the test. This report documents our analysis of the normalization of ASVAB forms 8, 9, and 10.

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NORMALIZATION OF THE ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB) FORMS 8, 9, AND 10 USING A SAMPLE OF SERVICE RECRUITS

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EXECUTIVE SUMMARY

All branches of the Armed Services use the Armed Services Vocational Aptitude Battery (ASVAB) to measure the mental aptitude of prospective recruits. Current plans call for implementing a new series of the ASVAB (forms 8A, 8B, 9A, 9B, 10A, and 10B)[1] in October 1980.

Before implementing the new forms of ASVAB, the test must be normalized,[2,3] that is, the proper relationship must be established between the number of questions answered correctly (the raw score) and the percentile score. This procedure ensures that a certain score on the new forms represents the same ability level as did that same score on previous forms of the test. To reduce the possibility of error in the normalization of ASVAB 8/9/10, four independent analyses were conducted. This report describes one of these analyses.

The data for this analysis were obtained by administering both the new ASVAB and a reference test to 3,799 recruits from the Army, Navy, Air Force, and Marine Corps at service reception centers. The testing was carried out under carefully controlled conditions designed to provide equal motivation and opportunity to do well on both the ASVAB and the reference test. Because neither the new ASVAB nor the reference test were being used operationally, there was no possibility that coaching distorted the scores.

The mix of recruits from each service was selected to equal the normal annual percentage of all recruits who choose that service. To obtain the most accurate equating of the new ASVAB to the reference test, the sample was adjusted so the ethnic and sex mix were the same as the sample originally used to norm the reference test.

The data were carefully analyzed for spurious scores, and any suspect cases were removed from the sample. We established that any bias in our results from using recruits who were tested and selected before enlistment rather than using the more traditional service applicants is negligible.

The results of our analyses for the Armed Forces Qualification Test (AFQT) part of the ASVAB are given in table I. Results for the ASVAB subtests and composites are given in appendices H and J, respectively.

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[1]Commonly referred to as ASVAB 8/9/10.

[2]The words normalized, equated, scaled, or calibrated are frequently used interchangeably to describe the same process.

[3]This report was initially issued as a working paper in June 1980 to permit a DoD decision on norms for ASVAB 8/9/10 prior to the October 1980 implementation date. The results given in this final report are unchanged from those shown in the working paper.

TABLE I

CONVERSION TABLE FOR ASVAB 8A AFQT SCORE

Raw score	Percentile score	Raw score	Percentile score
0-24	0	66	32
25	1	67	33
26	2	68	35
27	3	69	36
28	4	70	38
29	4	71	41
30	5	72	43
31	5	73	45
32	6	74	47
33	6	75	49
34	7	76	50
35	8	77	52
36	9	78	54
37	9	79	56
38	10	80	58
39	10	81	60
40	11	82	61
41	11	83	63
42	12	84	65
43	12	85	67
44	13	86	69
45	13	87	70
46	14	88	72
47	14	89	74
48	15	90	76
49	15	91	77
50	16	92	79
51	16	93	80
52	17	94	82
53	18	95	83
54	19	96	85
55	20	97	86
56	21	98	88
57	22	99	90
58	23	100	91
59	24	101	92
60	25	102	93
61	26	103	95
62	27	104	97
63	28	105	99
64	30		
65	31		

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CHAPTER 1

INTRODUCTION

BACKGROUND

The Armed Services Vocational Aptitude Battery (ASVAB) is the screening test currently used by the Armed Services to measure the mental aptitude of prospective recruits. On 1 January 1976, two forms, 6 and 7 (ASVAB 6/7), were implemented at the Armed Forces Examining and Entrance Stations (AFEES). These forms were supplemented by two additional forms, 6E and 7E, in June 1979, making a total of four forms of ASVAB that are now being used. This series is referred to as ASVAB 6/7/6E/7E.

Current plans call for replacing ASVAB 6/7/6E/7E with a new series, designated ASVAB 8/9/10, in October 1980. This report is about the normalization of this new series.[1]

THE STRUCTURE OF ASVAB 8/9/10

ASVAB 8/9/10 consists of 10 subtests (table 1) that comprise two groups (see appendix A). One group of subtests make up the Armed Forces Qualification Test (AFQT) part of the battery; the remainder form the non-AFQT portion. The AFQT part of the ASVAB is used to determine eligibility for enlistment. Some services further use certain non-AFQT subtests to determine eligibility. The Department of Defense also uses the AFQT to place recruits in broad mental categories that serve as measures of general trainability. The non-AFQT subtests are used primarily for job classification. The ASVAB 8/9/10 series consists of six different forms of the AFQT subtests (8A, 8B, 9A, 9B, 10A, and 10B) combined with three different forms of the non-AFQT subtests (8, 9, 10) to produce six forms (8A, 8B, 9A, 9B, 10A, and 10B) of the battery.

PLANS FOR NORMALIZATION

Since ASVAB 6/7 was introduced in January 1976, there has been considerable controversy over whether it was properly normalized (see reference 1). In developing ASVAB 8/9/10 the ASVAB Working Group[2] hoped to resolve any uncertainty about the normalization of these tests before implementing them. Therefore, the

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[1]This report was initially issued as a working paper in June 1980 to permit a DoD decision on norms for ASVAB 8/9/10 before the October implementation date.

[2]A joint service group that deals with ASVAB issues. It is composed of policy and technical representatives from each service.

ASVAB Working Group recommended a series of four concurrent normalization analyses for ASVAB 8/9/10, and the ASVAB Steering Committee[1] approved the series. One normalization analysis was to be based on the full ASVAB 8A administered to applicants at the AFEES--this analysis was to be conducted by the Army Research Institute (ARI). A second normalization analysis based on an administration of the full ASVAB 8A to recruits at service reception centers was to be conducted by the Center for Naval Analyses (CNA). A third normalization analysis was to be based on an administration of the AFQT part of ASVAB 8A to students in high schools--this analysis was to be conducted by the Educational Testing Service (ETS). It was expected that at least two of these analyses would agree on the normalization of ASVAB 8A, and it was hoped that all three might agree.

TABLE 1

THE STRUCTURE OF ASVAB 8/9/10

Subtest	Content area	Number of questions	Testing time (minutes)
GS	General Science	25	11
AR[a]	Arithmetic Reasoning	30	36
WK[a]	Word Knowledge	35	11
PC[a]	Paragraph Comprehension	15	13
NO[a]	Numerical Operations	50	3
CS	Coding Speed	84	7
AS	Auto and Shop Information	25	11
MK	Mathematics Knowledge	25	24
MC	Mechanical Comprehension	25	19
EI	Electronics Information	20	9
		334	144

[a]These tests comprise the AFQT part of the battery: $AFQT = AR+WK+PC+(\frac{NO}{2})$.

[1]The flag officer oversight committee for the ASVAB Working Group.

Because all six of the new ASVAB forms had been constructed to be parallel,[1] it was expected that the same conversion tables could be used for all forms. To ensure that the six forms were indeed parallel, a fourth study was to be conducted based on tests administered to recruits at service reception centers. This study, to be conducted by the Air Force Human Resources Laboratory (AFHRL), was to compare the means and standard deviations of each subtest of forms 8B, 9A, 9B, 10A, and 10B with the like-named subtest from form 8A to ascertain if the tests are in fact parallel (or comparable).

If the three independent normalizations of ASVAB 8A agree and if the comparability study shows that the six forms are in fact parallel, then ASVAB 8/9/10 can be implemented with a high degree of confidence.

This report only concerns CNA's normalization analysis based on tests administered to recruits at service reception centers. The other normalization analyses are to be presented in separate reports issued by the responsible organizations.

ORGANIZATION OF THE REPORT

The experimental details of this analysis are discussed in chapter 2 and are presented in more detail in the appendices. The resulting normalization is discussed in chapter 3.

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[1]The six forms of the prototype ASVAB were constructed from item banks developed by the Air Force Human Resources Laboratory (AFHRL). These items were then administered to high school students in spring 1979 to obtain a uniform set of item parameters. Members of the Psychometric Task Group (a subgroup of the ASVAB Working Group) then grouped the items by difficulty and by correlation with the total subtest score. The six most similar items were chosen, one assigned to each of the six new forms, and so forth, until all forms contained the desired number of items. In this manner, six new forms of the ASVAB were constructed that were expected to be parallel (or nearly parallel). See reference 2 (page 207) for a discussion of the methodology.

CHAPTER 2

ANALYSIS

EXPERIMENTAL DESIGN

The normalization analysis discussed here is based on test scores obtained by administering both ASVAB 8A and a reference test, AFQT 7A, to recruits from all services at service reception centers (see appendix B for details). The tests were administered between 18 January and 9 February 1980. The number of recruits chosen from each service reflected the percentage of applicants from that service that flow through the AFEES.[1] The testing order was counterbalanced[2] for recruits from each service.

Testing personnel from the responsible service personnel laboratories visited each reception center. During their visit, they briefed the local testing personnel on the procedures to be followed and observed at least one complete testing session.

DATA SAMPLE

To minimize equating errors, the data sample used to equate ASVAB 8A to AFQT 7A had to be similar to that used in the original normalization of AFQT 7A. For this reason, we restricted the data sample to male recruits only.[3] For this same reason, we adjusted the racial-ethnic mix of the sample to 12 percent "black," 82 percent "white," and 6 percent "other." The initial data sample consisted of 3,799 male cases.

Except for the initial testing session at each reception center, none of the sessions were monitored. For this reason, we focused considerable attention on removing from the sample any data that seemed likely to have been biased by maladministration. We discuss later our procedure for removing bad data.

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[1]For the services, these were 43.3 percent, Army; 23.3 percent, Navy; 20.0 percent, Air Force; and 13.4 percent, Marine Corps.

[2]Counterbalanced means that the same number of recruits took ASVAB 8A first as took the reference test first.

[3]The male-only restriction was particularly important because AFQT 7A contains some questions about tools although ASVAB 8A AFQT does not. Because females traditionally do less well on tool-related items than males, and because no females were used in the original norming of AFQT 7A, the norms of ASVAB 8A would have been biased if females had been included in the sample.

The recruits marked their answers on optically scannable answer sheets. The answer sheets were machine scored. A 1 percent random sample of answer sheets from ASVAB 8A was rescored by hand and no errors were found. A 2 percent random sample of answer sheets from AFQT 7A was also rescored by hand and one error was found. This error rate was small and acceptable because most resulting spurious data would be removed at later stages of the analysis.

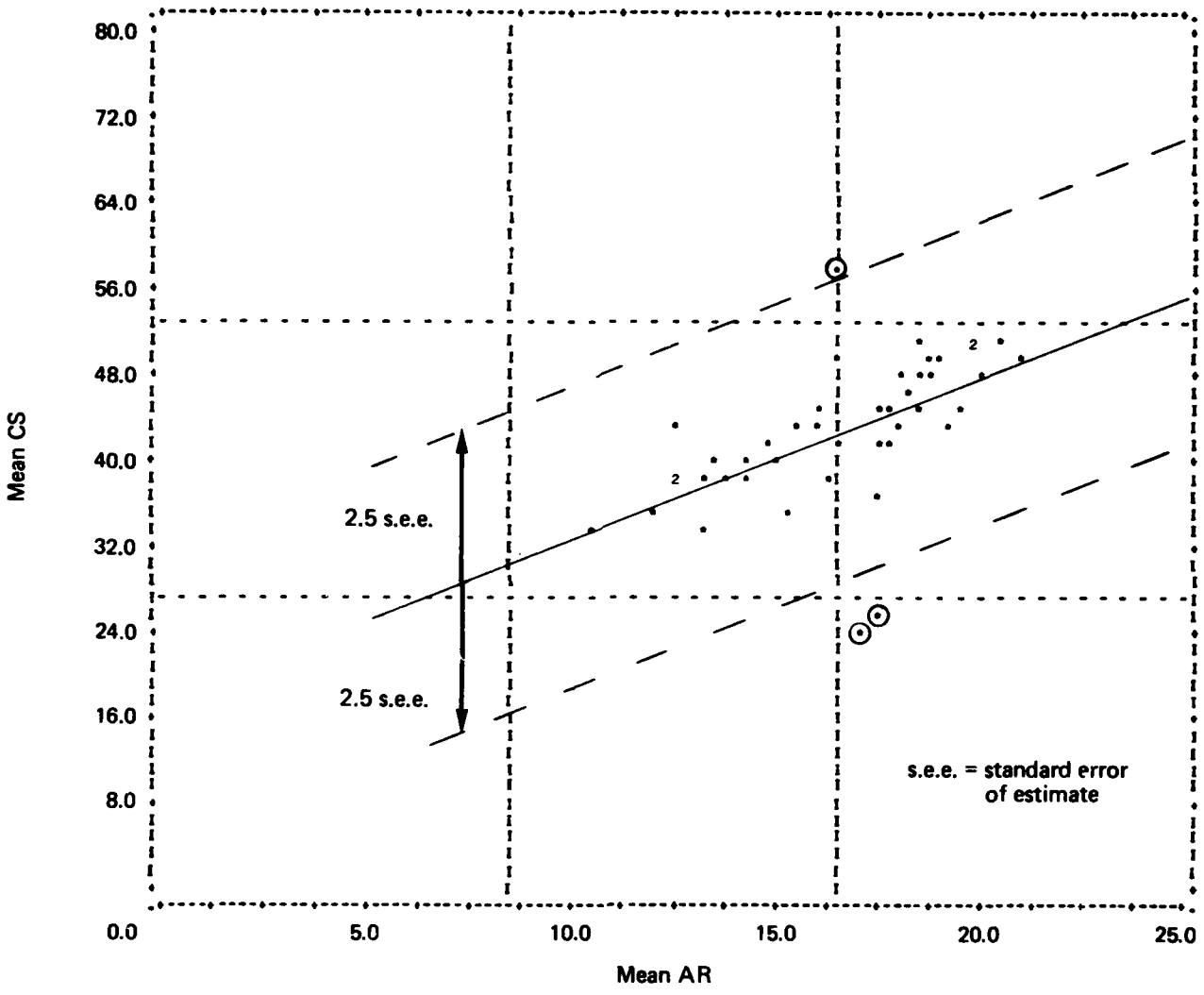
REMOVAL OF SPURIOUS DATA

In general, spurious data are of two types. One type is from maladministration in testing such as mistiming. In such a case, all data from that testing session are biased and should be removed. A second type of bad data results when an individual test must be discounted because a person becomes sick or otherwise indisposed during the testing or if a test is improperly scored. In this case, the individual case should be removed from the sample. We explored both types of problems.

We examined the problem of maladministration by computing mean scores for each subtest for each day of testing at each test site. For each subtest there was another subtest that correlated reasonably well with the first. We constructed scattergrams of the mean values of the correlated subtests and looked for anomalous points. The procedure is illustrated in figure 1. This figure shows the mean values of the Coding Speed and Arithmetic Reasoning subtests for 44 different testing sessions. A regression line was fit to the data. Three data points are seen to be displaced from the regression line by more than 2.5 standard errors where none would be expected in a normal distribution. These three data points, representing three testing sessions, were removed from the sample. Scattergrams of correlated means for other pairs of tests were also examined and are shown in appendix C. Using the criteria just discussed, we removed 9 of the 44 testing sessions as cases of probable maladministration. This selection reduced the data sample to 3,293 cases.

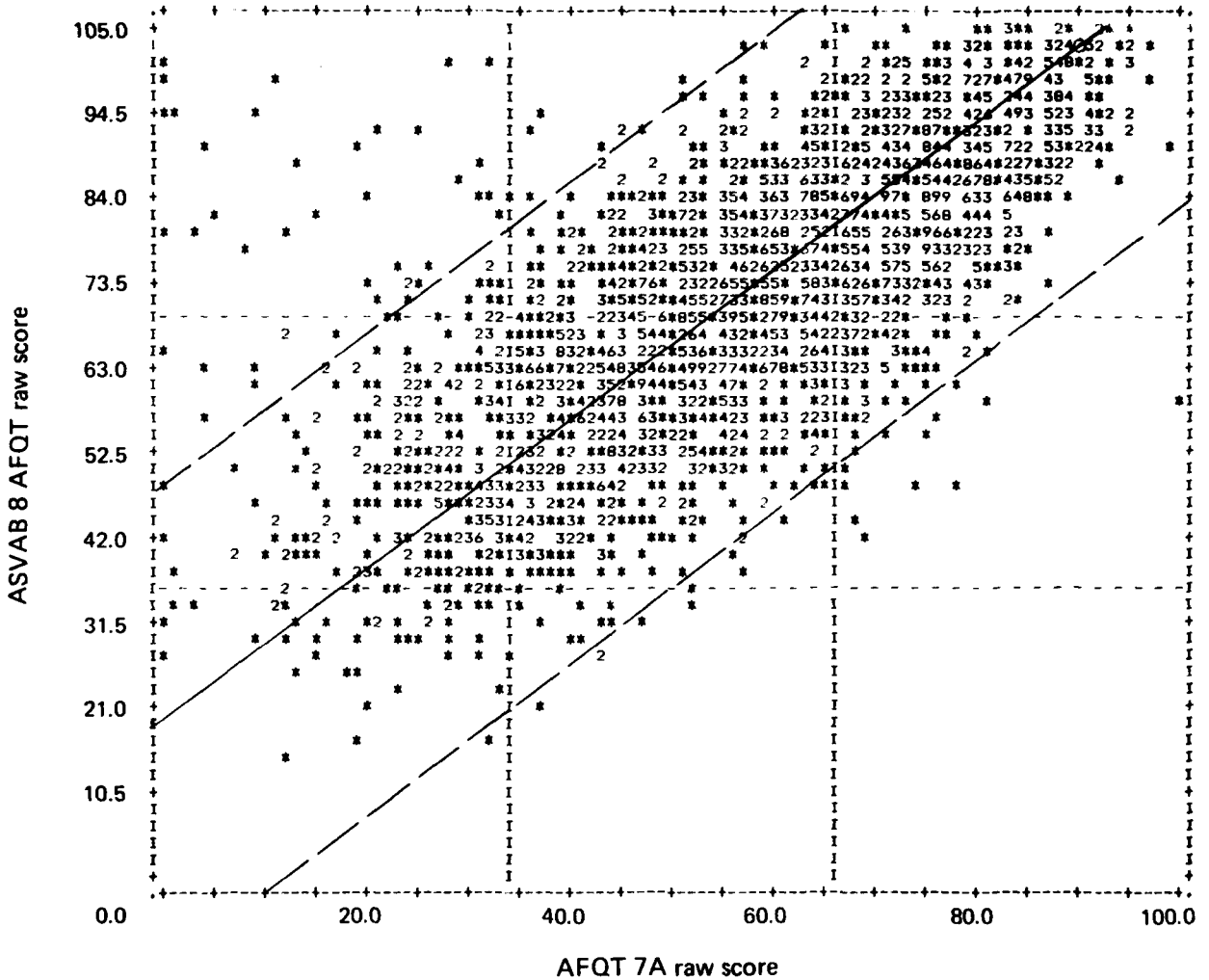
At this point in the analysis, data from tests administered at AFEES to these recruits became available. Because this information would be useful in examining possible bias due to preselection at AFEES, the AFEES test file was matched to our reception center data file. Because not all cases were successfully matched, our data set was reduced to 3,084 cases.

To delete any remaining cases of bad test scores on individuals, we examined a scattergram (figure 2) of individual scores on ASVAB 8A AFQT and the reference test. Note the excess of points in the upper left corner of the figure. The data were



Note: Circled data points denote test sessions removed from our data sample. The symbol "•" denotes a single testing session. Intergers "2" through "8" represent the indicated number of sessions and the interger "9" denotes nine or more sessions.

FIG. 1: ILLUSTRATION OF REMOVAL OF TESTING SESSIONS WHERE MALADMINISTRATION WAS SUSPECTED[a]



Note: Dashed lines denote 2.5 standard error limit.

FIG. 2: ILLUSTRATION OF REMOVAL OF INDIVIDUAL CASES WITH SPURIOUS SCORES

parameterized with a linear regression equation and points falling outside 2.5 standard errors were removed (see appendix D for details). The removal of these cases reduced our data sample to 3,001 cases. Thus, we had a clean data set of 3,001 cases for further analysis.

EQUIPERCENTILE EQUATING

The equipercentile equating method (reference 3 and figure 3) was used to equate graphically the raw scores on the new ASVAB 8A AFQT to percentile scores on the reference test AFQT 7A. Two scores were considered equivalent if they were made by the same cumulative percentage of a sample (point "A" in figure 3). Hence, the raw scores on the ASVAB at point "B" were defined as equal to the percentile scores on the reference test at point "C."

The ASVAB 8A AFQT was normalized in appendix E using this procedure. However, before we discuss these results, we examine the possibility that a normalization based on recruit data (such as ours) is biased due to preselection at AFEES.

EFFECT OF SAMPLE TRUNCATION

The effect of preselection at AFEES is illustrated in figure 4. Figure 4(a) shows the distribution of scores on the operational ASVAB 6/7 AFQT expected from applicants at AFEES. Those applicants in the shaded area of figure 4(a) are rejected for enlistment because of low test scores. Those in the unshaded area are accepted for enlistment and become recruits such as those who make up our data sample. Hence, a distribution of scores of recruits on a test administered at AFEES is said to be truncated due to direct selection on the test administered at AFEES. When these recruits are retested at reception centers, as is the case with the data used in our analysis, the distribution of retest scores is also distorted by the preselection at AFEES. The tests given at reception centers are highly correlated with the operational test administered at AFEES. Hence, removal of the shaded area in figure 4(a) by rejecting low-aptitude applicants results in a similar, but less sharply defined, removal of low-aptitude cases in the shaded areas of figures 4(b) and 4(c). These cases are said to be removed by incidental selection.

The unshaded areas in figures 4(b) and 4(c) represent the distributions used in our sample to normalize ASVAB 8A. If the incidental selection affects the distributions of scores on ASVAB 8A differently than those on the reference test, then our normalization of ASVAB 8A is biased. If, on the other hand, it does not affect them differently, then our results are not biased.

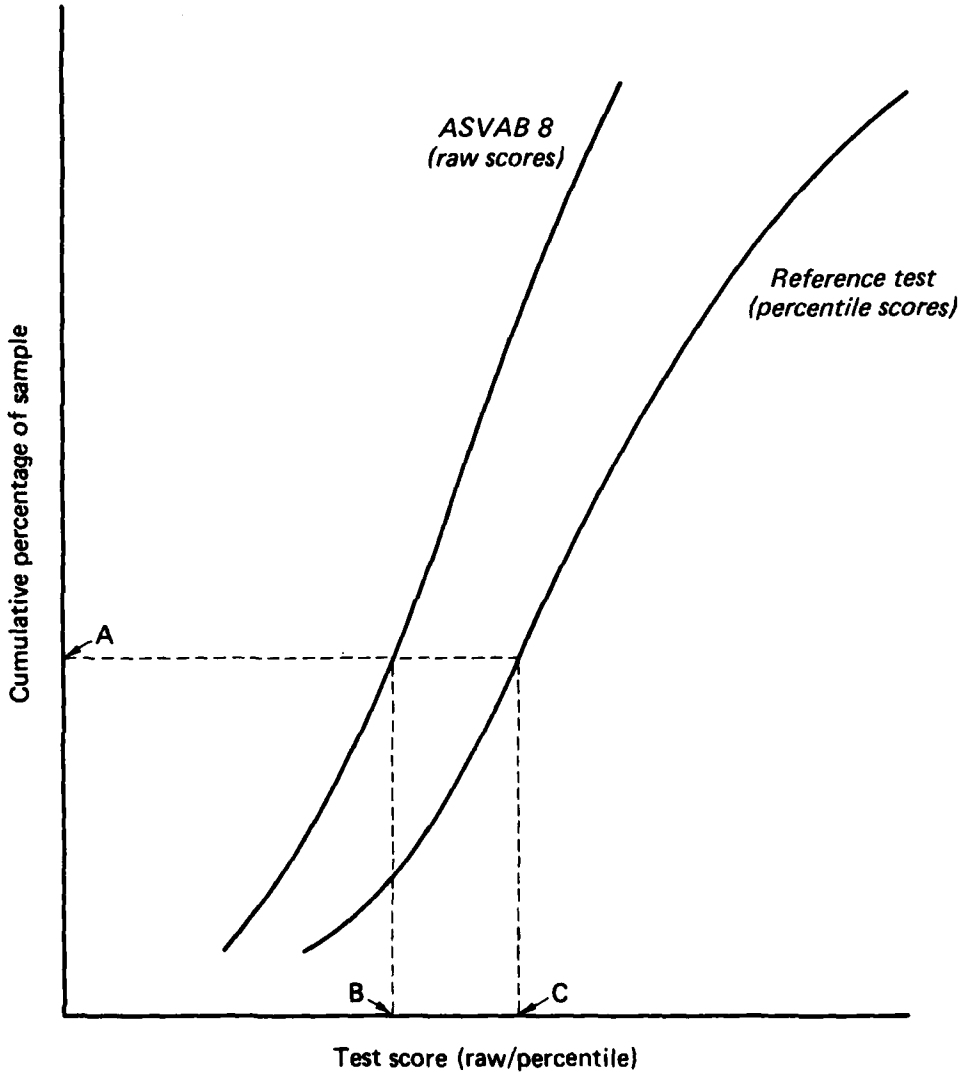


FIG. 3: ILLUSTRATION OF EQUIPERCENTILE EQUATING

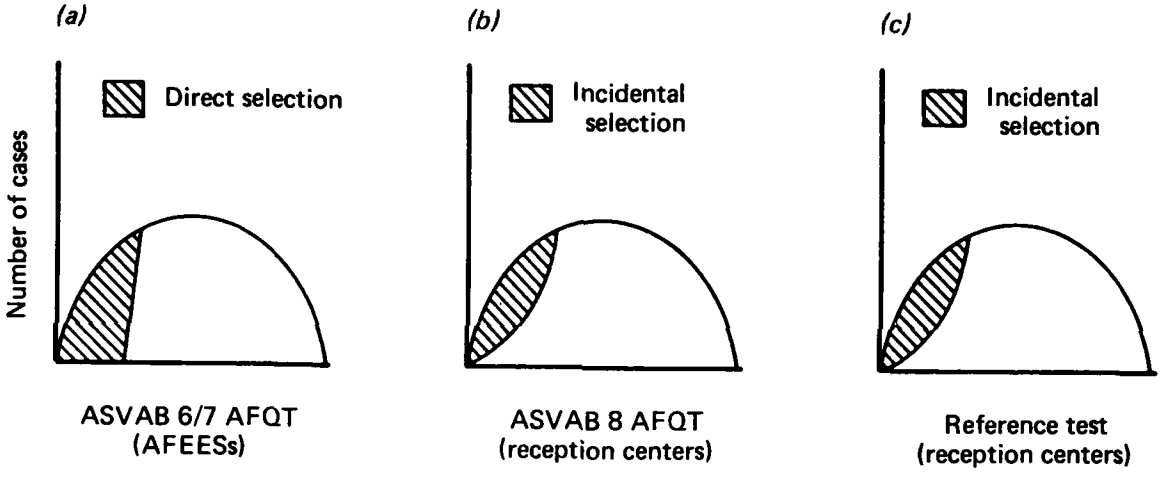


FIG. 4: ILLUSTRATION OF DIRECT AND INCIDENTAL TEST SELECTION ON A SAMPLE OF RECRUITS

To examine this situation, we obtained a full-range data set based on tests administered at AFEES. The data set was made available by ARI and consisted of the scores of applicants on the same three tests that were administered to our recruit sample. (The details are given in appendix F.) First we normalized ASVAB 8A using the ARI full-range data set. Then we truncated this data set exactly as our data set was truncated and got a second normalization of ASVAB 8A from this "truncated" ARI data set. A comparison of the two sets of norms gave us a measure of the bias, if any, due to truncation at AFEES. Details of the comparison are given in appendix F. The estimated bias (in percentile points) is shown for each AFQT decile in table 2. The bias is seen to be small (less than 1 percentile point) and is probably on the order of the uncertainty inherent in the graphical equipercentile equating procedure. We concluded that any bias in our ASVAB 8 AFQT normalization from sample truncation due to preselection at AFEES was negligible.

TABLE 2

ESTIMATE OF BIAS IN AFQT NORM DUE TO PRESELECTION AT AFEES

ASVAB 8 AFQT (percentile score)	Mean "bias" in indicated AFQT decile due to truncation of sample (percentiles)
0 - 9	0.3
10 - 19	- 0.3
20 - 29	- 0.3
30 - 39	- 0.4
40 - 49	- 0.3
50 - 59	0.0
60 - 69	0.0
70 - 79	- 0.5
80 - 89	0.2
90 - 99	0.0

CHAPTER 3

RESULTS

NORMALIZATION OF ASVAB 8A AFQT

Raw scores from ASVAB 8A AFQT were equated to percentile scores from the reference test by the equipercentile equating method (see appendix E). The results are shown in table 3.

NORMALIZATION OF ASVAB 8A SUBTESTS

To produce subtest standard scores we stratified[1] the sample on the reference test AFQT 7A, as described in appendix G. The mean value and standard deviation of each ASVAB 8A subtest were obtained from this stratified sample. Subtest standard scores were obtained for each subtest raw score by the relation

$$\text{ASVAB Standard Score} = 50 + 10\,\frac{(X_i - \bar{X})}{\sigma_X},$$

where X_i is the i^{th} raw score of subtest X, $\bar{X}$ is the mean raw score of subtest X, and σ_x is the standard deviation of subtest X. Details are given in appendix H.

We note that the subtest standard scores given in appendix H are only approximately correct. The stratification procedure necessary to produce the subtest scores introduces a small, but unavoidable bias. This bias is discussed in reference 4 with respect to its effect on norms for AFQT percentile scores. It was estimated that the effect on AFQT scores from using a stratified technique on a truncated sample could be as large as 5 percentile points in the lower percentiles. For that reason, we (and reference 4) used an equipercentile equating technique rather than a stratification technique when norming the AFQT

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[1]Stratification means weighting the cases in the sample so that the distribution of AFQT 7A percentile scores contains an equal number of cases in each decile. In so doing, one standardizes the sample so that resulting statistics have a common basis for comparison with those from other analyses, that is, they are relatively independent of the sample used to collect the data.

TABLE 3

CONVERSION TABLE FOR ASVAB 8A AFQT SCORE

Raw score	Percentile score	Raw score	Percentile score
0-24	0	66	32
25	1	67	33
26	2	68	35
27	3	69	36
28	4	70	38
29	4	71	41
30	5	72	43
31	5	73	45
32	6	74	47
33	6	75	49
34	7	76	50
35	8	77	52
36	9	78	54
37	9	79	56
38	10	80	58
39	10	81	60
40	11	82	61
41	11	83	63
42	12	84	65
43	12	85	67
44	13	86	69
45	13	87	70
46	14	88	72
47	14	89	74
48	15	90	76
49	15	91	77
50	16	92	79
51	16	93	80
52	17	94	82
53	18	95	83
54	19	96	85
55	20	97	86
56	21	98	88
57	22	99	90
58	23	100	91
59	24	101	92
60	25	102	93
61	26	103	95
62	27	104	97
63	28	105	99
64	30		
65	31		

percentile score. We expected the effect of a stratification bias on subtest standard scores to be much less than 5 percentile points.[1]

NORMALIZATION OF ASVAB 8A COMPOSITES

ASVAB 8A composites were formed from sums of subtest standard scores as indicated in appendix A. The sums of standard scores were equated by the equipercentile method to AFQT 7A. To minimize bias due to stratification we performed the equating using unstratified data. The details are shown in appendix I, and the resulting conversion tables are given in appendix J.

STANDARD STATISTICS FOR ASVAB 8A

The data sample was stratified on AFQT 7A and standard statistics produced. Subtest means and correlations are shown in appendix K.

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[1]The stratification bias with respect to AFQT norms in truncated data sets was a function of two items: first the question of "true score" versus "observed score" for individuals retested after preselection had removed the lower percentiles, and second, the non-zero measurement error inherent in all tests. In the case of using stratified data to produce subtest standard scores, only the second of the two items was a factor; hence, the bias was considerably reduced.

REFERENCES

1. Office of the Principal Deputy Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), "History of the Armed Services Vocational Aptitude Battery (ASVAB) 1974-1980," by the ASVAB Working Group, Unclassified, May 1980

2. Gulliksen, Harold, "Theory of Mental Tests," John Wiley and Sons, New York, 1950

3. Robert L. Thorndike, "Educational Measurement," American Council on Education, Washington, D.C., Unclassified, 1971

4. Center for Naval Analyses, Study 1152, "A Reexamination of the Normalization of the Armed Services Vocational Aptitude Battery (ASVAB) Forms 6, 7, 6E, and 7E," by William H. Sims and Ann R. Truss, Unclassified, Apr 1980

APPENDIX A

DEFINITIONS OF ASVAB TESTS AND COMPOSITES

APPENDIX A

DEFINITIONS OF ASVAB TESTS AND COMPOSITES

The definitions of each of the tests[1] in the ASVAB are given in table A-1. Army and Marine Corps composites are defined in tables A-2, A-3, and A-4. Air Force composites are defined in table A-5. Because only subtest scores are reported for Navy recruits, no explicit composites are shown for this service.

[1]These tests are also referred to as subtests.

TABLE A-1

INDIVIDUAL ASVAB 8 TESTS

GS = General Science

AR = Arithmetic Reasoning

WK = Word Knowledge

PC = Paragraph Comprehension

NO = Numerical Operations

CS = Coding Speed

AS = Auto & Shop Information

MK = Mathematics Knowledge

MC = Mechanical Comprehension

EI = Electronics Information

VE[a] = Verbal

[a]VE = WK + PC.

TABLE A-2

ASVAB 8 COMPOSITES FOR
ARMY AND/OR MARINE CORPS

AFQT = Armed Forces Qualification Test

GT = General Technical

GM = General Maintenance

EL = Electronics

CL = Clerical

MM = Mechanical Maintenance

SC = Surveillance & Communications

CO = Combat

FA = Field Artillery

OF = Operators & Food Handlers

ST = Skilled Technical

TABLE A-3

FORMULAS FOR COMPUTING ARMY ASVAB 8 COMPOSITES

AFQT[a] = AR + NO/2 + VE

GT = AR + VE

GM = GS + AS + MS + EI

EL = GS + AR + MK + EI

CL = NO + CS + VE

MM = NO + AS + MC + EI

SC = NO + CS + AS + VE

CO = AR + CS + AS + MC

FA = AR + CS + MK + MC

OF = NO + AS + MC + VE

ST = GS + MK + MC + VE

[a]AFQT is defined as a sum of subtest raw scores. All other composites are defined as sums of subtests in ASVAB standard score form.

TABLE A-4

FORMULAS FOR COMPUTING MARINE CORPS ASVAB 8 COMPOSITES

AFQT[a] = AR + NO/2 + VE

GT = AR + VE

GM = GS + AS + MK + EI

EL = GS + AR + MK + EI

CL = NO + CS + VE

MM = AR + AS + MC + EI

CO = NO + AS + VE

FA = AR + AS + VE

[a]AFQT is defined as a sum of subtest raw scores. All other composites are defined as the sum of subtests in ASVAB standard score form.

TABLE A-5

FORMULAS FOR COMPUTING AIR FORCE ASVAB 8 COMPOSITES

AFQT[a] = AR + NO/2 + VE

M = GS + 2AS + MC

A = NO + CS + VE

G = AR + VE

E = GS + AR + MK + EI

[a]AFQT is defined as a sum of subtest raw scores. All other composites are defined as the sum of subtests in ASVAB standard score form.

APPENDIX B

EXPERIMENTAL DESIGN

APPENDIX B

EXPERIMENTAL DESIGN

The test score data were collected during special test administrations at reception centers between 18 January and 9 February 1980. The number of recruits scheduled to be tested at each test site is shown in table B-1. Also shown in table B-1 is the testing order and the service research organization responsible for monitoring the testing.

The Army and Marine Corps tested more recruits than their normal fraction of accessions. They did so because these services generally access a large percentage of lower-aptitude recruits. This larger number of low-aptitude recruits is particularly important to us in accurately establishing norms in the lower percentiles because the proportion of recruits in these percentiles had been reduced by preselection at AFEES. However, to maintain overall service balance in the sample, the numbers of recruits were weighted before analysis to achieve the following percentage input by service: Air Force, 20.0 percent; Army, 43.3 percent; Marine Corps, 13.4 percent; and Navy, 23.3 percent.

To minimize any effects due to the order of administering ASVAB 8 and the reference test, all testing was counterbalanced within each service, as shown in table B-1.

To ensure standard test administration, the first test session at each reception center was monitored. The monitors were personnel from the service personnel research laboratories: Army Research Institute (ARI), Center for Naval Analyses (CNA), Naval Personnel Research and Development Center (NPRDC), and Air Force Human Resources Laboratory (AFHRL).

After the tests were administered, the answer sheets were returned to CNA for processing. All sheets were examined and identifying information was checked and corrected as necessary. The AFQT 7A answer sheets were optically scanned and scored by ARI. The ASVAB 8 answer sheets were optically scanned and answers recorded by the Marine Corps Institute. The recorded answers were then compared with the correct answers and scores computed by CNA.

A 1 percent random sample of ASVAB 8 answer sheets was scored by hand and no discrepancies with the machine scores were found. A 2 percent random sample of AFQT 7A answer sheets was scored by hand. In this sample, we found two minor errors and one major error. We considered the error rate small enough so that with reasonable care in rejecting spurious scores (discussed in appendix D), a reliable data set could be obtained.

TABLE B-1

RECEPTION CENTER TESTING QUOTA

Service	Reception center	Number of recruits to be tested: Male	Number of recruits to be tested: Female	Testing order[a]	Monitor
Army	Ft. Bliss	100	0	B	ARI
	Ft. Sill	200	0	A	ARI
	Ft. McClellan	100	100	B	ARI
	Ft. Knox	300	0	B	ARI
	Ft. Dix	300	250	B	ARI
	Ft. Jackson	600	450	A	CNA
	Ft. Leonard Wood	100	200	B	ARI
		1,700	1,000		
Marine Corps	MCRD[b] Parris Island	500	100	A	CNA
	MCRD San Diego	500	0	B	NPRDC
		1,000	100		
Air Force	Lackland AFB	600	400	A and B[c]	AFHRL
Navy	NRTC[d] Great Lakes	250	0	A	NPRDC
	NRTC San Diego	250	0	B	NPRDC
	NRTC Orlando	200	500	A and B[c]	NPRDC
		700	500		

[a]Test order A is test AFQT 7A first and test ASVAB 8 second. Test order B is test ASVAB 8 first and test AFQT 7A second.
[b]MCRD = Marine Corps Recruit Depot.
[c]At these reception centers, test order was mixed with half of the recruits tested with order A and half tested with order B.
[d]NRTC = Navy Recruit Training Center.

APPENDIX C

REMOVAL OF NONSTANDARD TEST SESSIONS

APPENDIX C

REMOVAL OF NONSTANDARD TEST SESSIONS

In an attempt to identify maladministered test sessions, we examined mean test scores for each test site by date tested. Significant anomalies in mean scores might indicate that at some time during testing, one of the sites might have deviated from the proper testing procedure. By examining these anomalies, possible maladministered test sessions, which would bias our results, were identified and removed from our data sample. The method used is described in this appendix.

Mean scores of all subtests, AFQT 8, and AFQT 7A were calculated for each test site by date tested. Mean scores were then plotted for pairs of subtests with reasonably high correlation coefficients. A regression equation parameterizing these mean values was derived from our 44 data points. Each point represented a separate test administration. We expected 99 percent of all points to lie within 2.5 standard errors of the regression line. Points that fall outside 2.5 standard errors probably would represent sessions involving maladministration and were removed from our data sample.

Three nonstandard test sessions, circled in our scattergram of Arithmetic Reasoning (AR) and Coding Speed (CS) (figure C-1), were removed from the data set.

This procedure was followed for eight additional pairs of tests and is illustrated in figures C-2 through C-9. Regression equations, correlation coefficients, and standard errors of estimate (s.e.e.) are given in table C-1. Of the 44 test sessions, 9 were removed using this method.

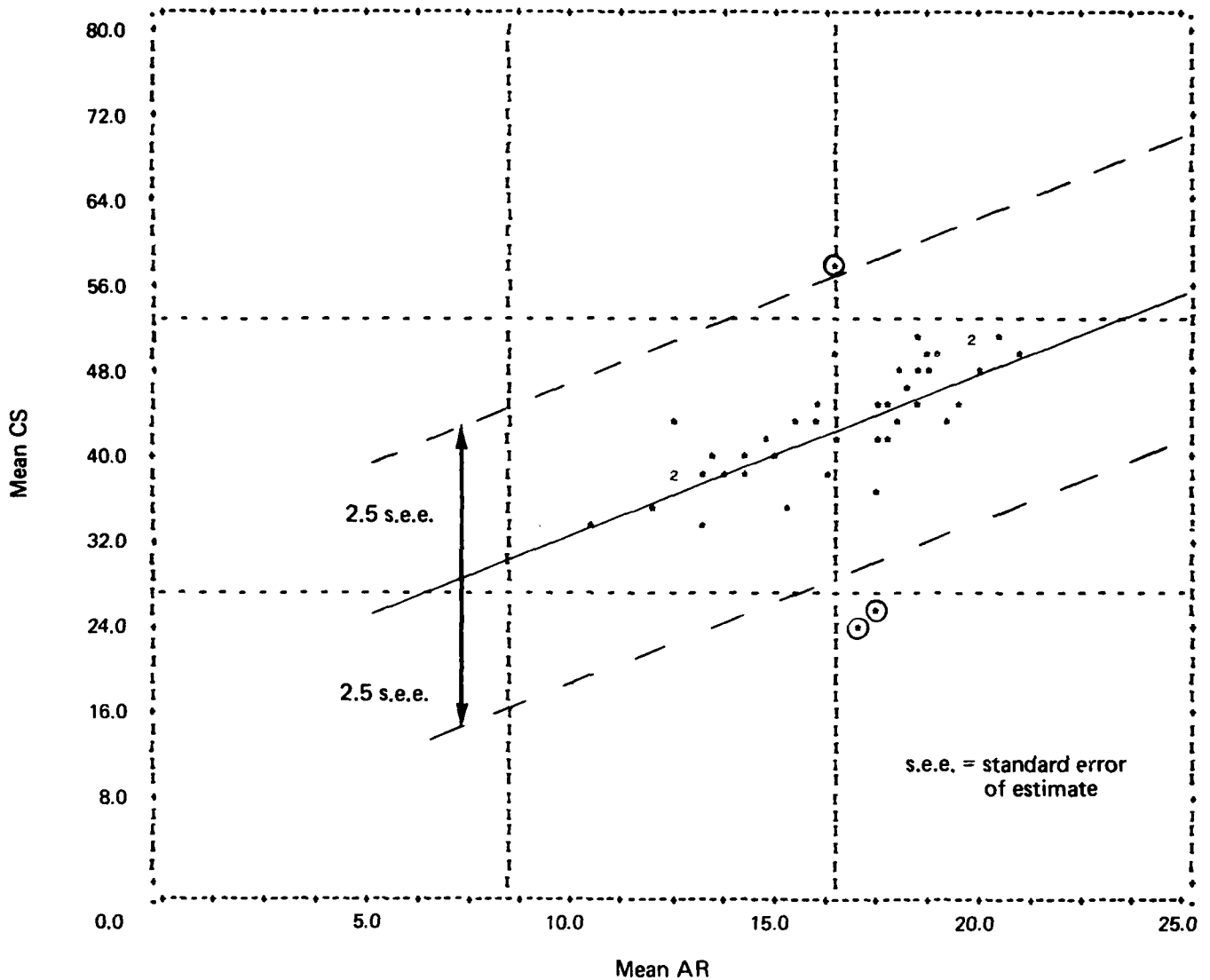


FIG. C-1: SCATTERGRAM OF MEAN AR AND MEAN CS BY TEST SESSION

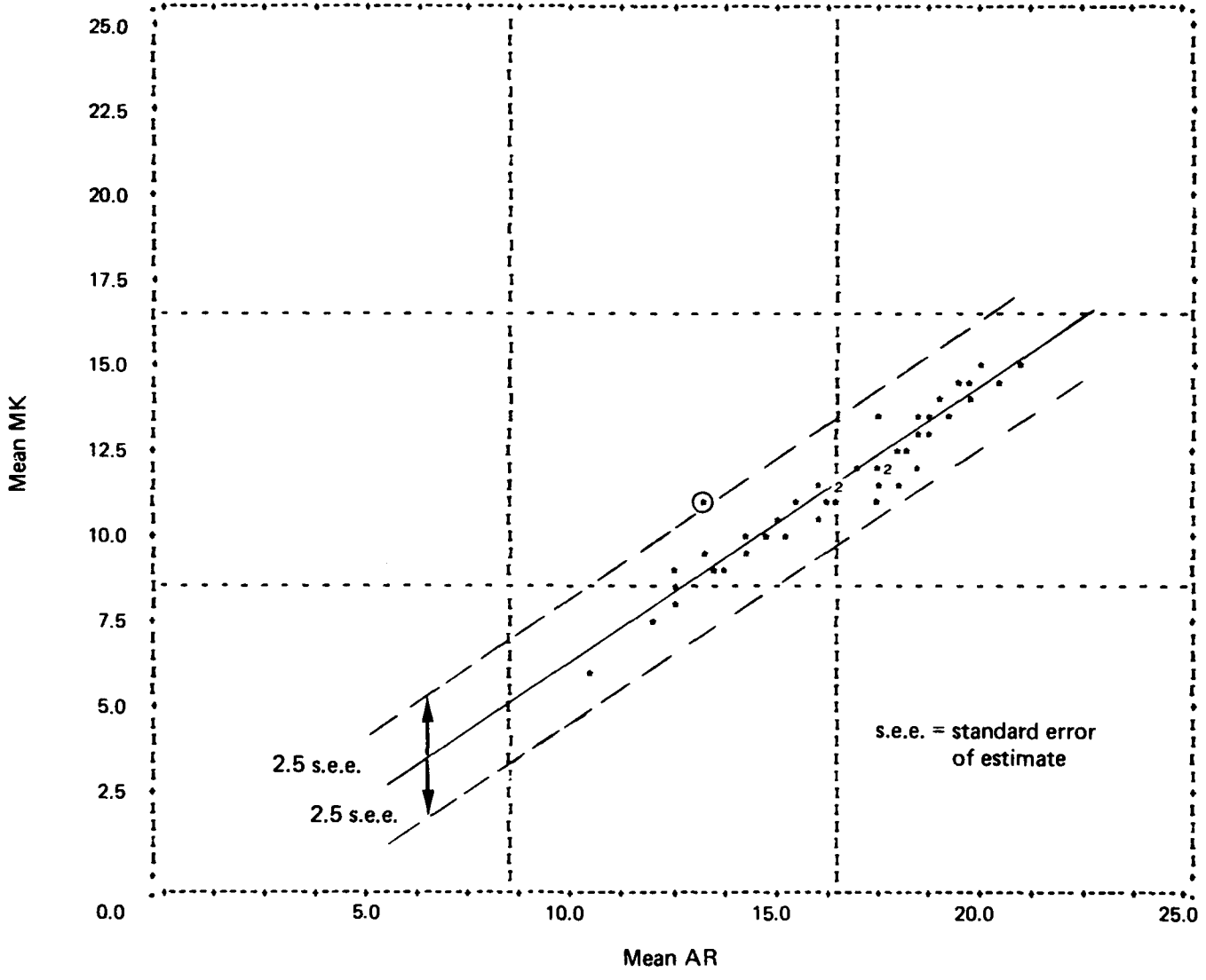


FIG. C-2: SCATTERGRAM OF MEAN AR AND MEAN MK BY TEST SESSION

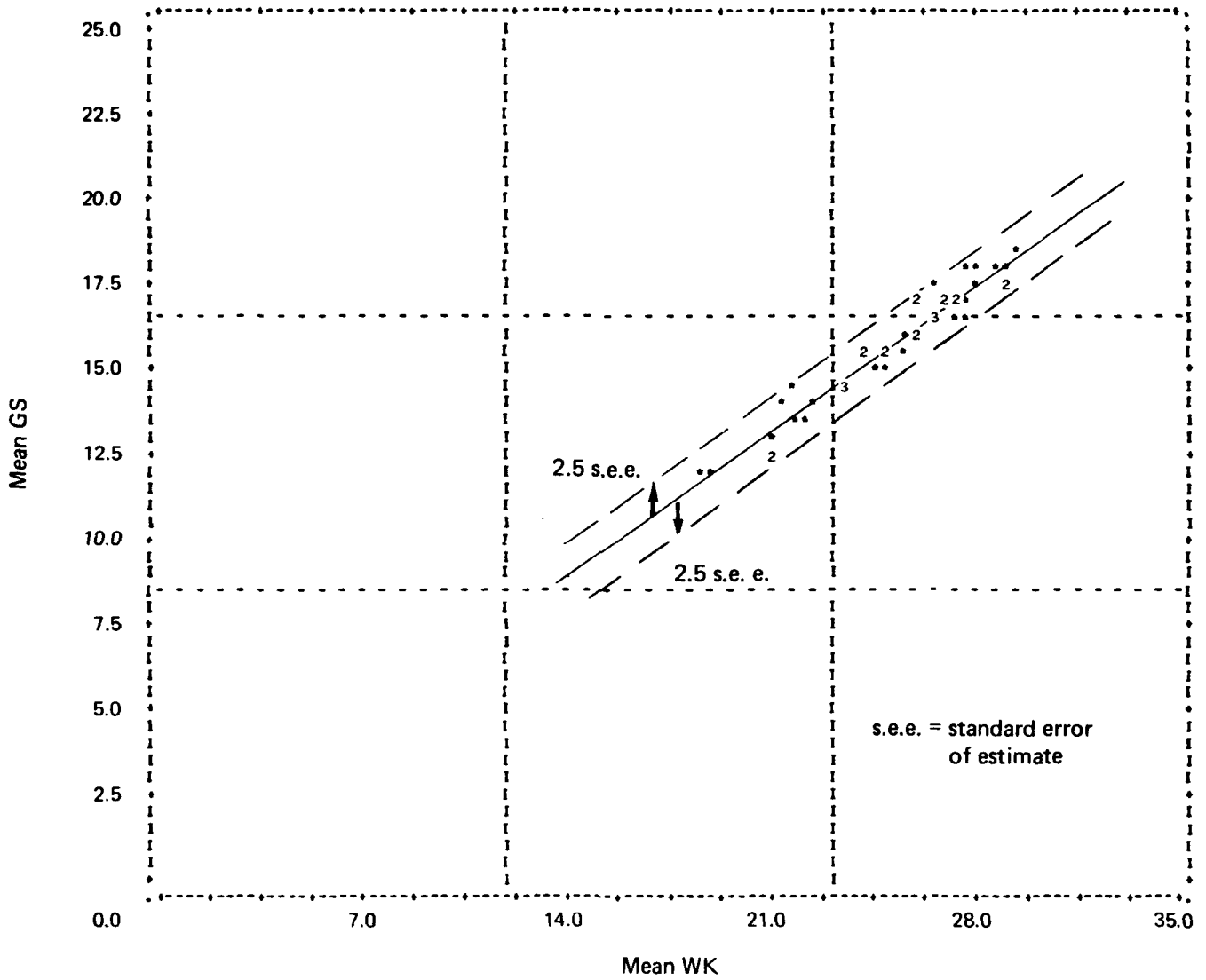


FIG. C-3: SCATTERGRAM OF MEAN WK AND MEAN GS BY TEST SESSION

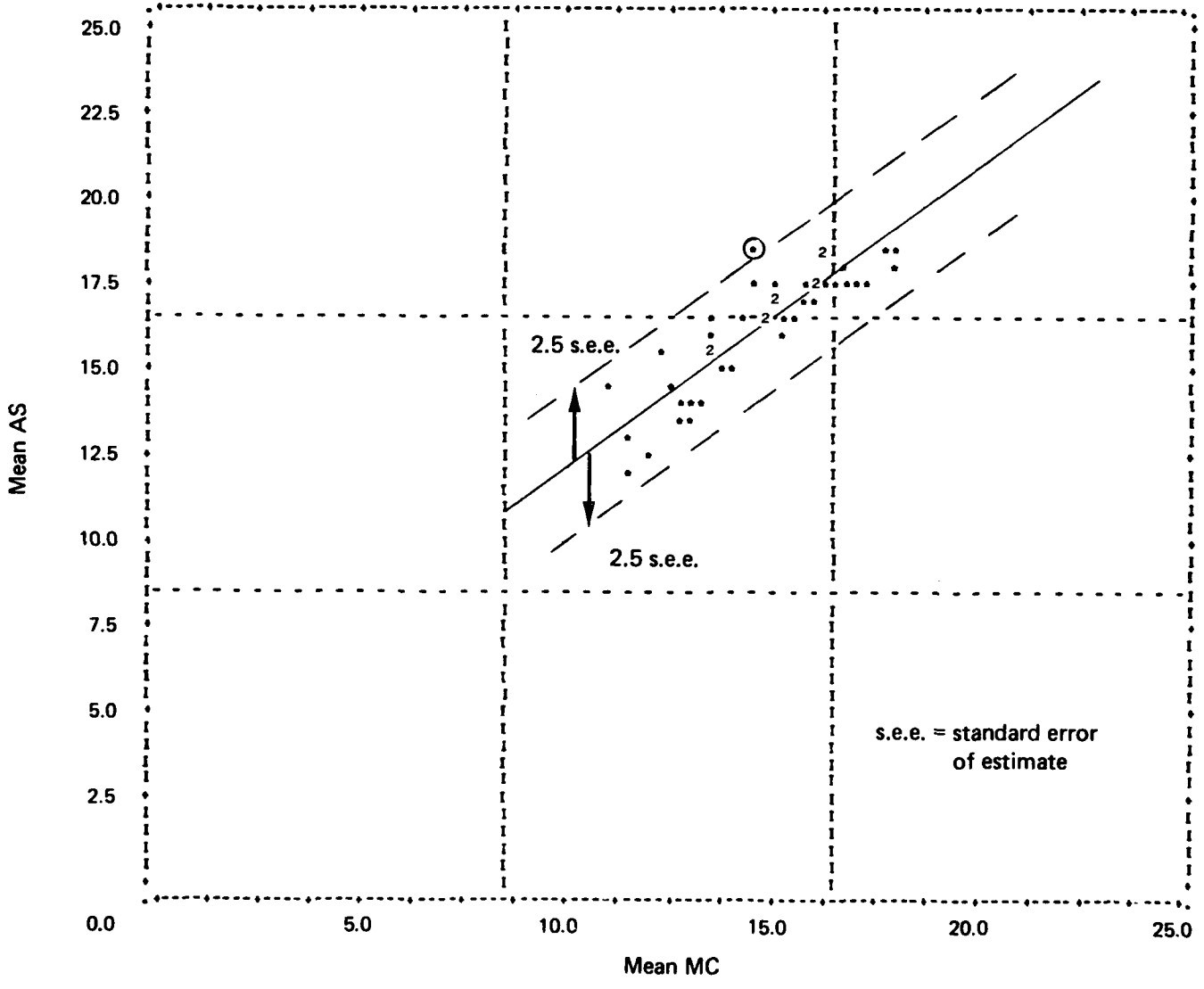


FIG. C-4: SCATTERGRAM OF MEAN MC AND MEAN AS BY TEST SESSION

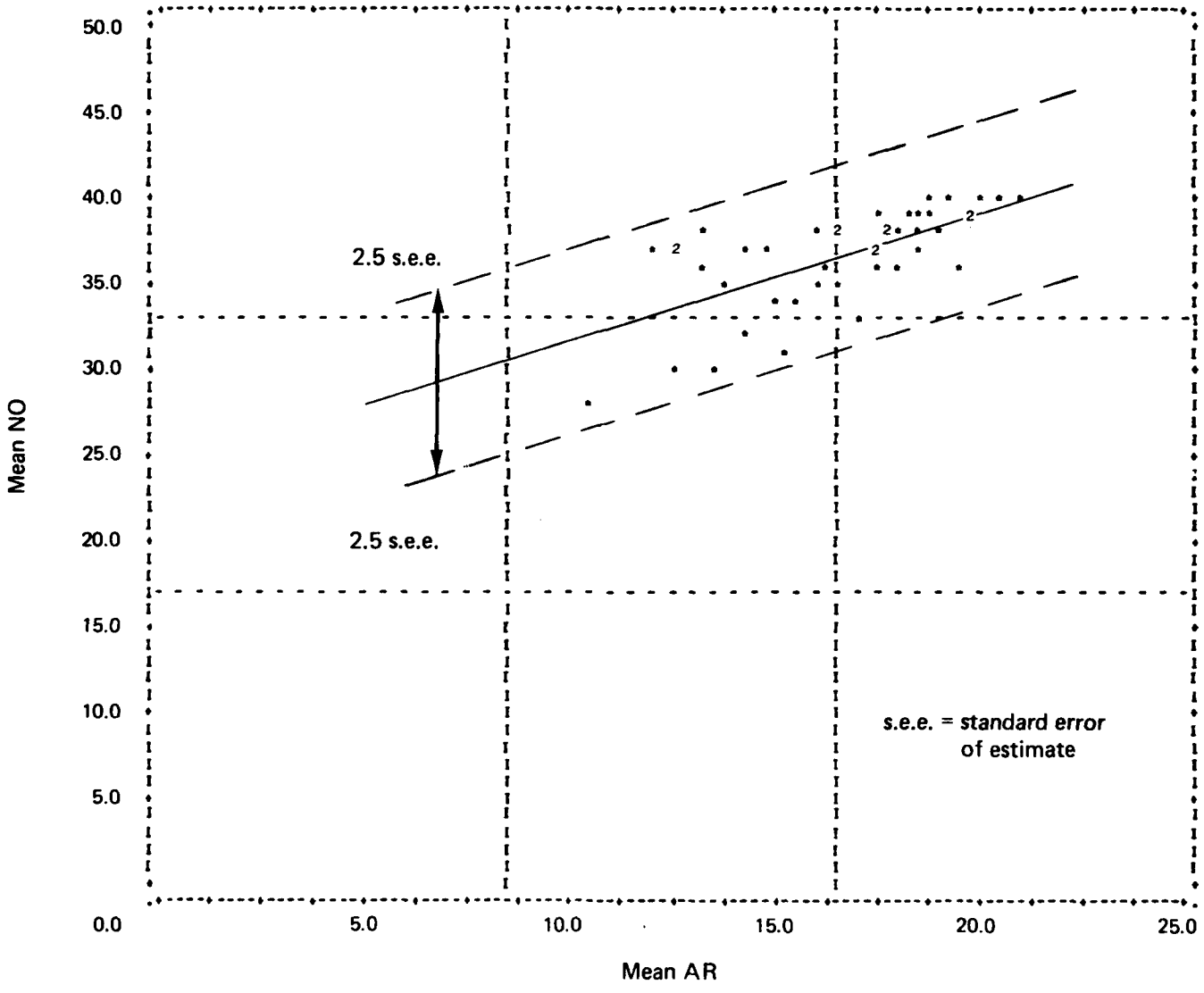


FIG. C-5: SCATTERGRAM OF MEAN AR AND MEAN NO BY TEST SESSION

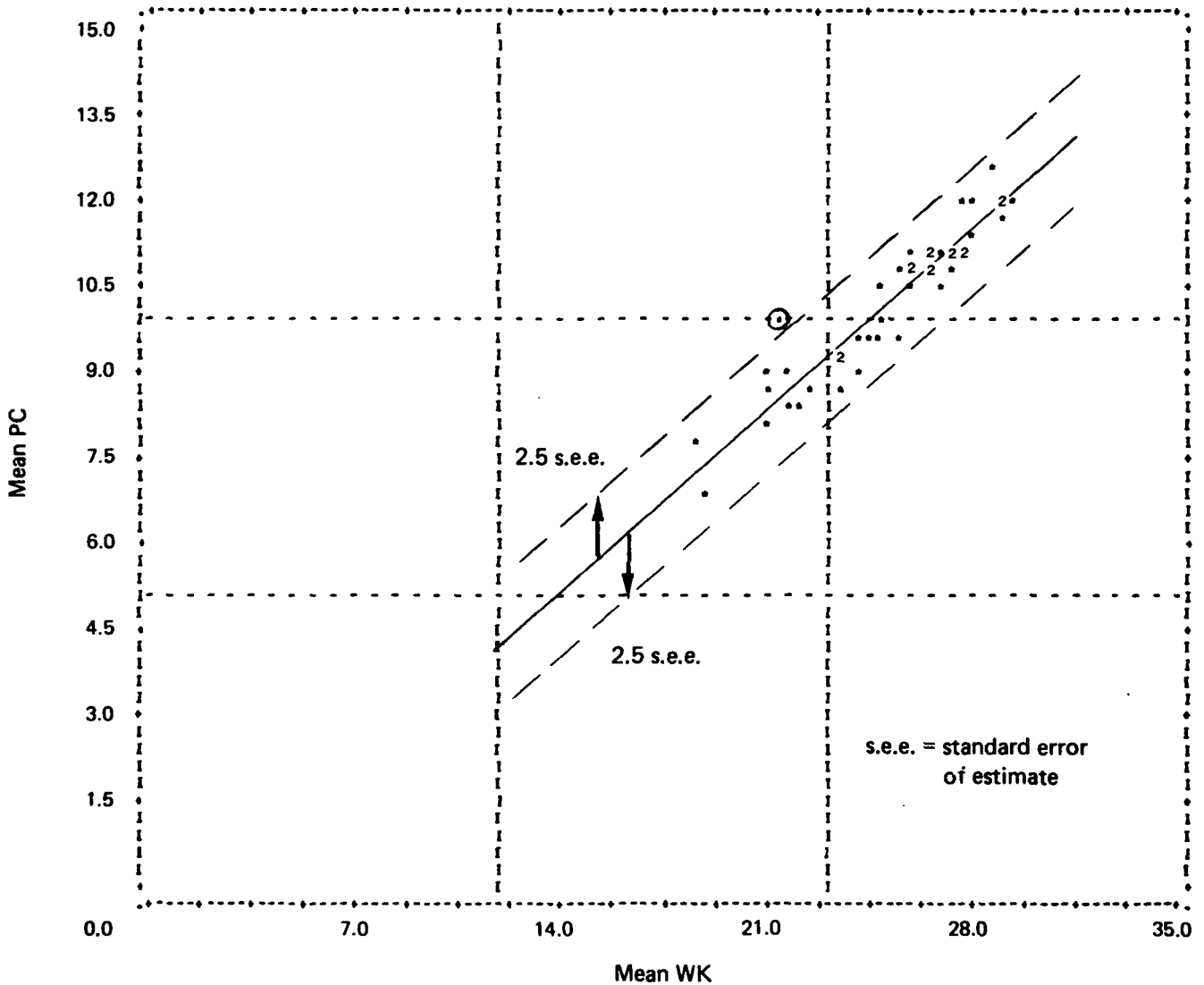


FIG. C-6: SCATTERGRAM OF MEAN WK AND MEAN PC BY TEST SESSION

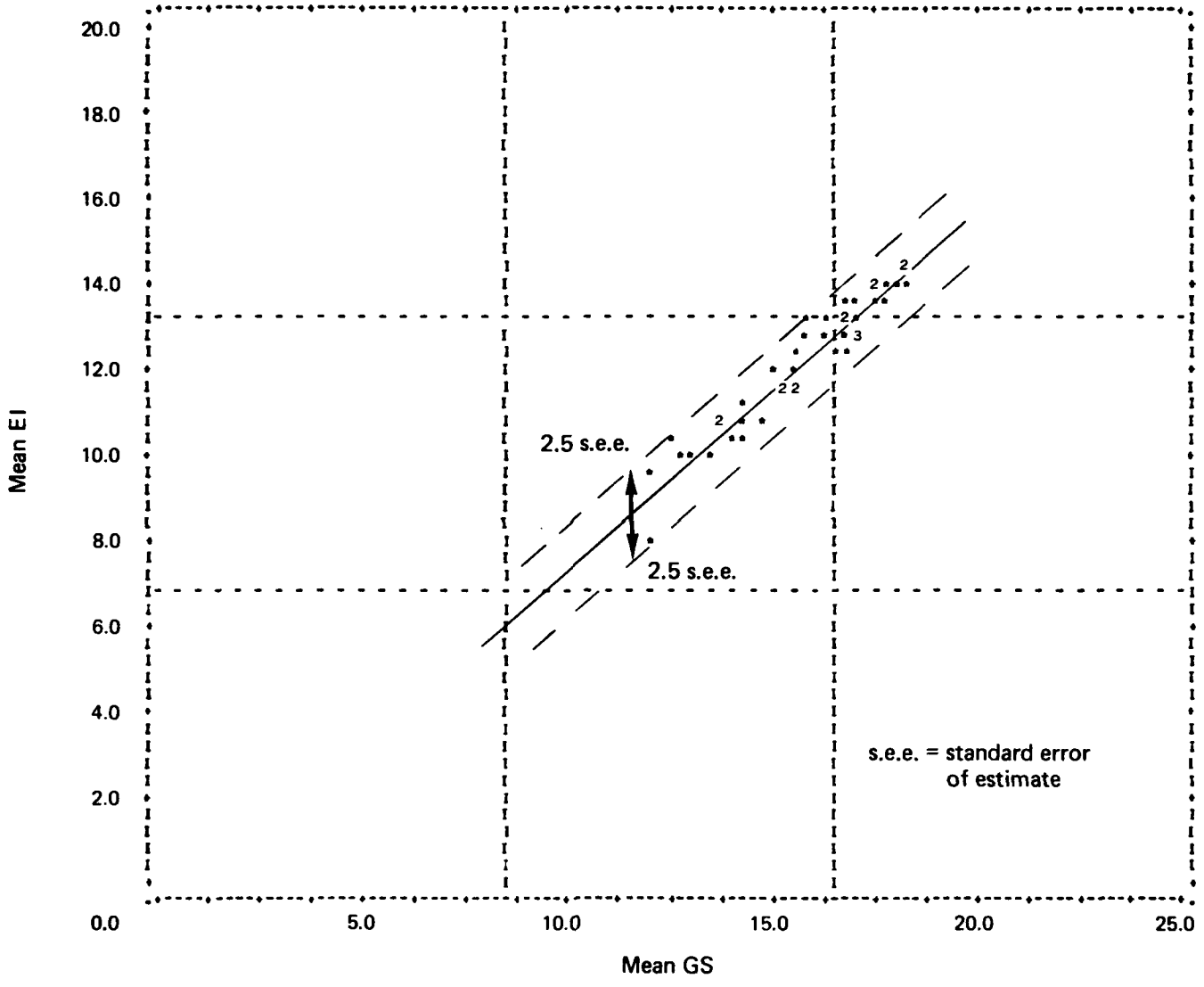


FIG. C-7: SCATTERGRAM OF MEAN GS AND MEAN EI BY TEST SESSION

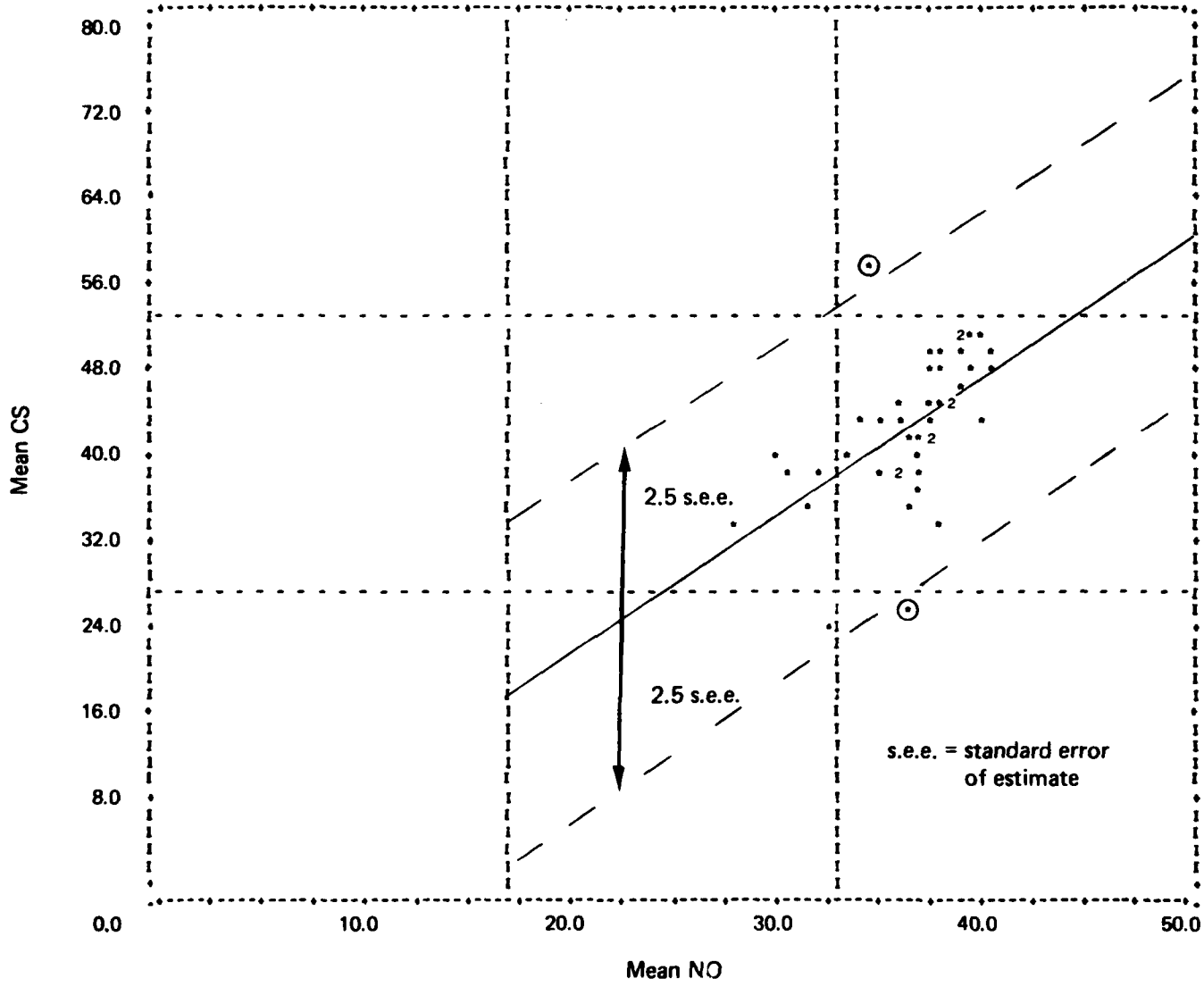


FIG. C-8: SCATTERGRAM OF MEAN NO AND MEAN CS BY TEST SESSION

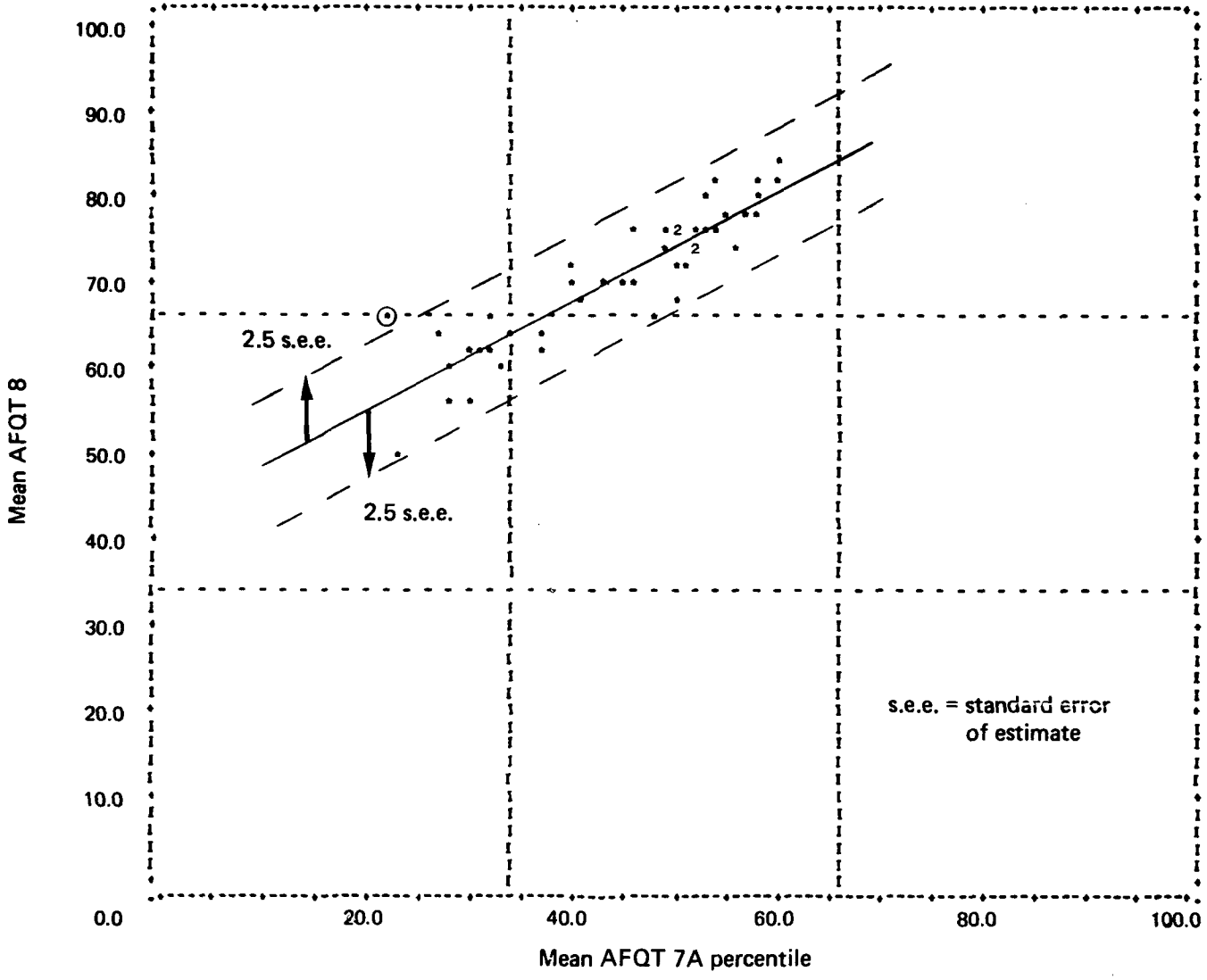


FIG. C-9: SCATTERGRAM OF MEAN AFQT 7A PERCENTILE AND MEAN AFQT 8 BY TEST SESSION

TABLE C-1

STATISTICS USED IN THE REMOVAL OF NONSTANDARD TEST SESSIONS

Regression equation[a]	Correlation coefficient	Standard error of estimate
MEAN CS = 1.51 (MEAN AR) + 17.74	0.58	5.53
MEAN MK = 0.77 (MEAN AR) - 1.26	0.96	0.60
MEAN GS = 0.61 (MEAN WK) + 0.40	0.98	0.39
MEAN AS = 0.85 (MEAN MC) + 3.75	0.87	0.89
MEAN NO = 0.75 (MEAN AR) + 24.14	0.67	2.17
MEAN PC = 0.45 (MEAN WK) - 1.06	0.94	0.44
MEAN EI = 0.84 (MEAN GS) - 1.06	0.96	0.48
MEAN CS = 1.27 (MEAN NO) - 3.80	0.55	5.69
MEAN ASVAB 8 AFQT = 0.64 (MEAN AFQT 7A PERCENTILE) + 42.27	0.91	3.26

[a]The methodology is described in detail in appendix D.

APPENDIX D

REMOVAL OF SPURIOUS TEST SCORES OF INDIVIDUALS

APPENDIX D

REMOVAL OF SPURIOUS TEST SCORES OF INDIVIDUALS

To explore the possibility of spurious test scores of individuals we examined a scattergram of AFQT 7A raw scores versus ASVAB 8 AFQT raw scores. First, all cases from those test sites (and testing dates) where maladministration was suspected were removed from the sample (see appendix C). The scattergram of the remaining 3,084 cases is shown in figure D-1. An excess of events with high scores on ASVAB 8 AFQT and low scores on AFQT 7A was noted. We assumed that these scores were spurious and should be removed.

To remove the spurious cases we parameterized the relationship between the two variables by a linear regression and removed those cases that fell 2.5 standard errors away from the regression line.

In general, there are two regression equations that result from an attempt to parameterize the relationship between two variables--X and Y. These equations are:

$$X = A + BY \qquad \text{(D-1)}$$

$$Y = C + DX. \qquad \text{(D-2)}$$

The results of regresson analysis applied to our data sample gave:

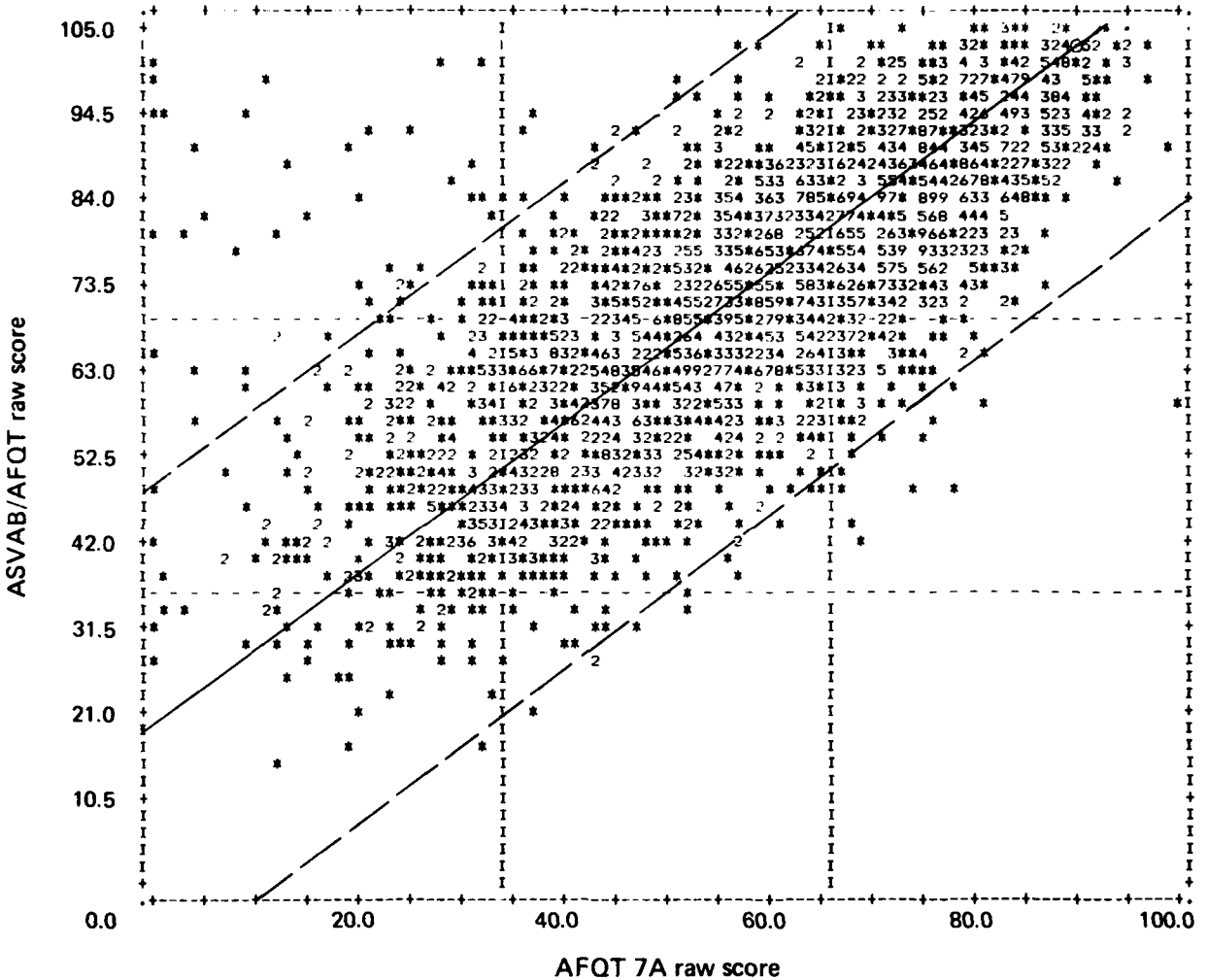
$$\text{ASVAB 8 AFQT} = 34.3 + 0.65\ \text{AFQT 7A} \qquad \text{(D-3)}$$

$$\text{AFQT 7A} = -1.3 + 0.82\ \text{ASVAB 8 AFQT}. \qquad \text{(D-4)}$$

Because both of the variables in figure D-1 had large measurement errors, neither equation (D-3) nor (D-4) was a correct parameterization of the data. We assumed that the measurement errors in each variable were similar and that the "best" parameterization was the "average" of equations (D-3) and (D-4). Accordingly, we computed the ASVAB 8 AFQT intercepts from both equations (D-3) and (D-4). Averaging these intercepts gave a "best" intercept of 17.8. We then constructed a line through this intercept and through the point defined by the mean values of ASVAB 8 AFQT and AFQT 7A (71.6 and 57.5):

$$\text{ASVAB 8 AFQT} = 17.8 + 0.94\ \text{AFQT 7A}. \qquad \text{(D-5)}$$

Equation (D-5) was our preferred parameterization of the data. The procedure is illustrated in figure D-2.



Note: Dashed lines denote 2.5 standard error limit.

FIG. D-1: SCATTERGRAM OF AFQT 7A RAW SCORES vs ASVAB 8 AFQT RAW SCORES

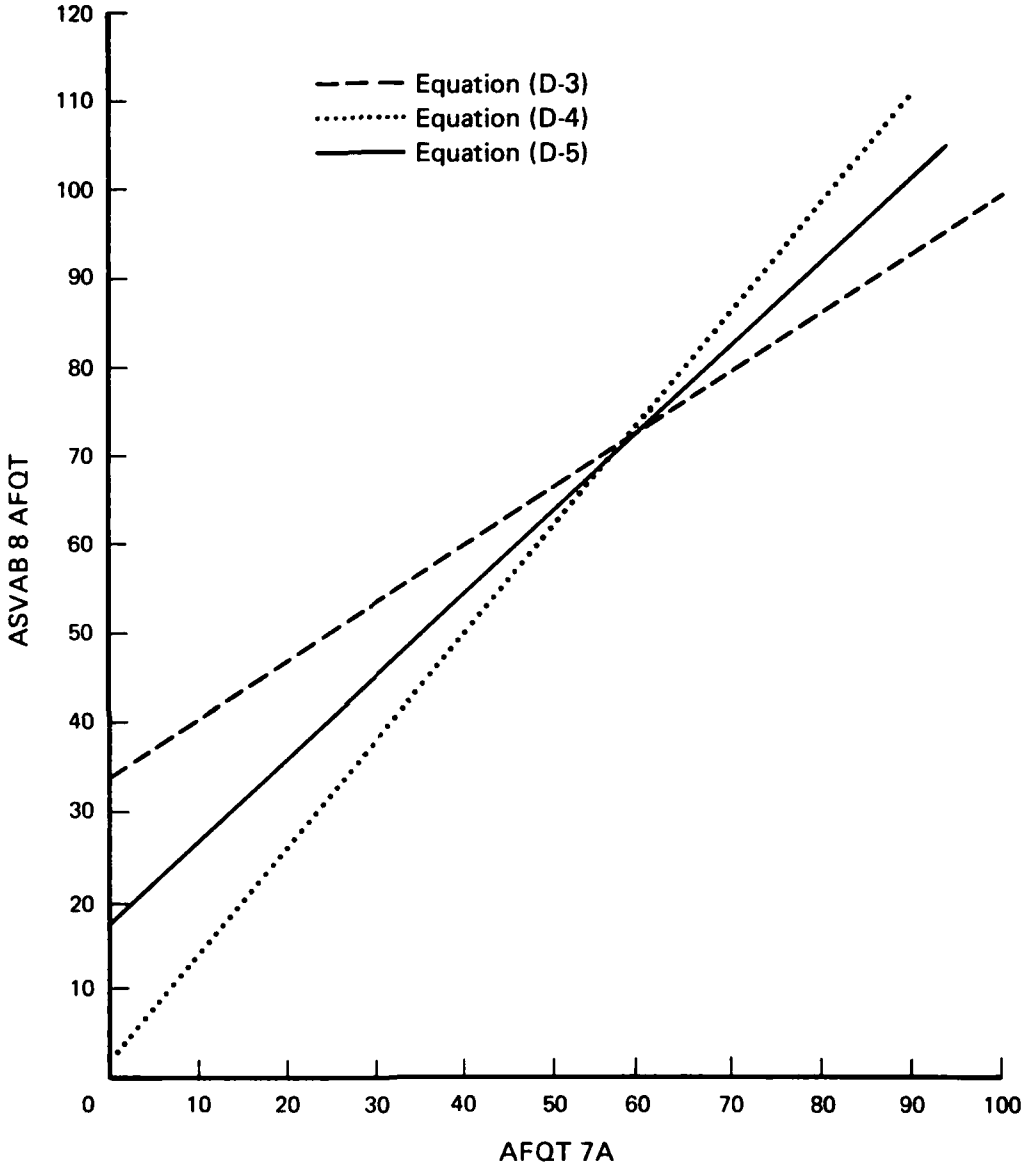


FIG. D-2: ILLUSTRATION OF VARIOUS PARAMETERIZATIONS OF THE DATA IN FIGURE D-1

To remove the bad data (in figure D-1) we used equation (D-5) and removed all cases that lay outside 2.5 standard errors from this line. For the standard error we used the value of 11.7 computed for equation (D-3). This procedure removed 84 cases (mostly from the upper left corner of figure D-1) leaving 3,001 cases for analysis.

APPENDIX E

EQUIPERCENTILE EQUATING

APPENDIX E

EQUIPERCENTILE EQUATING

Equipercentile equating was carried out for the full sample (3,550 male cases), the clean sample (3,001 male cases), and the clean sample with adjusted racial mix (2,546 cases). Cumulative frequencies of the ASVAB 8 AFQT raw score and the AFQT 7A percentile score were made and graphed for the three samples in figures E-1, E-2, and E-3. Scores on the two tests that were achieved by the same cumulative percentage of the sample were equated. In this manner, percentile scores were assigned to each ASVAB 8 AFQT raw score and were tabulated in table E-1.

The results in table E-1 are similar for all three samples. However, the results from the clean sample with adjusted minority percentages are preferred because this sample is less contaminated by spurious data and reflects the approximate racial mix[1] of the sample on which the reference test, AFQT 7A, was normed. Smoothed percentiles are our preferred conversions from ASVAB 8 raw scores to percentile scores.

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[1]The race-ethnic mix that we used for ASVAB 8 norming was 12 percent "black," 82 percent "white," and 6 percent "other." The race-ethnic mix used for the norming of AFQT 7A was unknown but believed to be representative of the mix of subgroups in the Armed Forces in 1959 when the test was normed. It is estimated that the mix at that time was 12 percent "black."

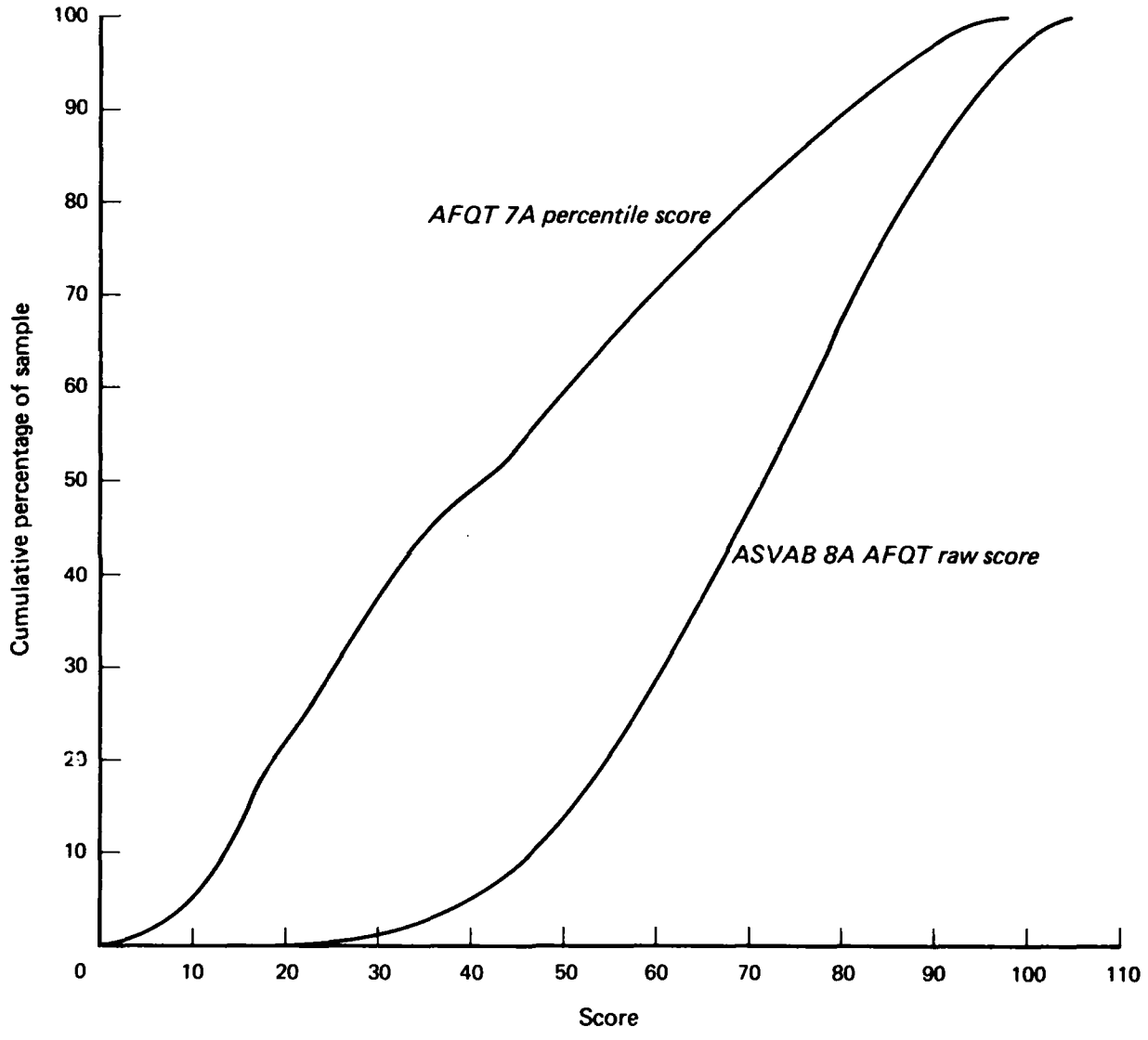


FIG. E-1: EQUIPERCENTILE EQUATING FOR TOTAL SAMPLE

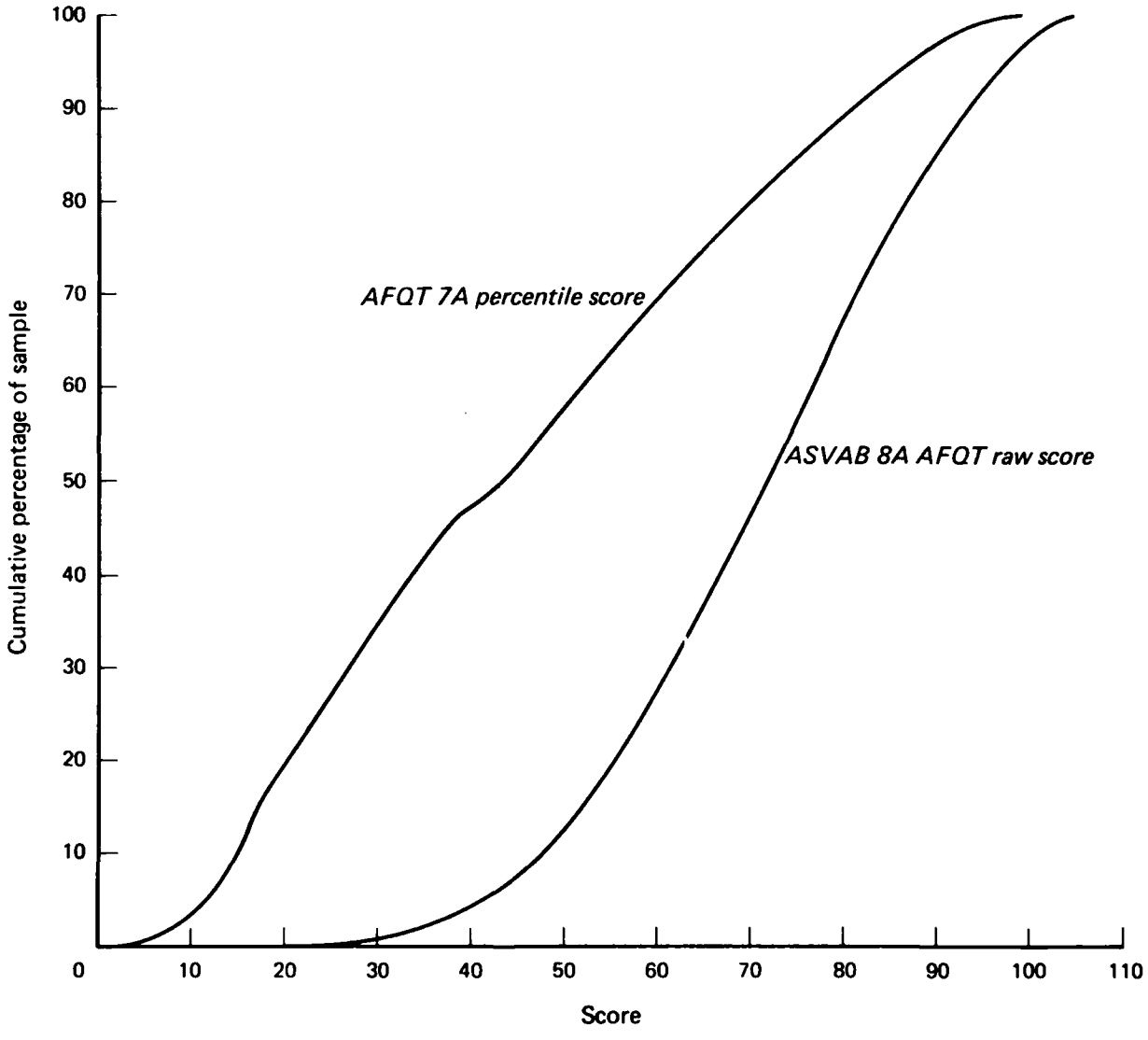


FIG. E-2: EQUIPERCENTILE EQUATING FOR CLEAN SAMPLE

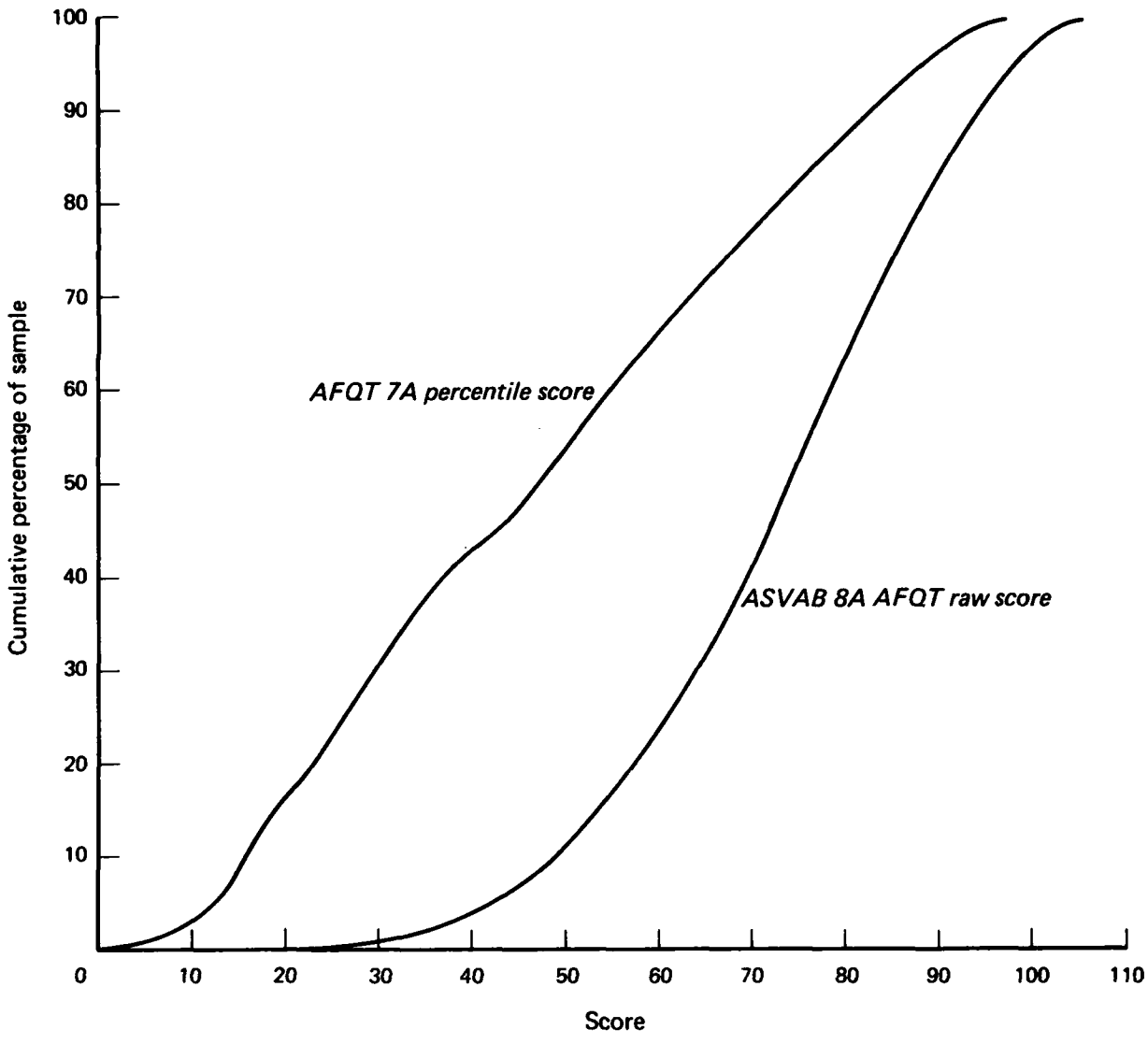


FIG. E-3: EQUIPERCENTILE EQUATING FOR CLEAN SAMPLE WITH ADJUSTED RACIAL MIX

TABLE E-1

SUMMARY OF EQUIPERCENTILE EQUATING RESULTS

ASVAB 8 AFQT (raw score)	Percentile			Smoothed percentiles from clean sample with adjusted racial mix
	Full sample (3,550 cases)	Clean sample (3,001 cases)	Clean sample with adjusted racial mix (2,546 cases)	
0-24	0.0	0.0	0.0	0
25	0.0	1.0	1.0	1
26	1.0	2.0	2.0	2
27	1.8	3.0	3.0	3
28	2.2	4.0	4.0	4
29	3.5	4.5	4.5	4
30	4.1	5.0	5.0	5
31	4.6	6.0	5.5	5
32	4.7	6.3	6.0	6
33	5.0	6.8	6.8	6
34	6.0	7.3	7.0	7
35	6.4	7.5	8.0	8
36	7.8	8.2	8.7	9
37	8.5	9.2	9.0	9
38	9.0	10.0	9.8	10
39	9.4	10.5	10.4	10
40	10.1	11.0	11.1	11
41	10.3	11.5	11.5	11
42	11.3	12.1	12.2	12
43	11.8	12.5	12.7	12
44	12.1	13.1	13.4	13
45	12.7	13.7	14.0	13
46	13.6	14.3	14.3	14
47	14.0	14.6	14.8	14
48	14.5	15.1	15.2	15
49	14.8	15.6	15.6	15
50	15.4	16.3	16.2	16
51	16.1	16.9	16.9	16
52	16.6	17.4	17.6	17
53	17.1	18.2	18.4	18
54	17.9	18.8	19.4	19
55	18.8	19.6	20.3	20

TABLE E-1 (Cont'd)

ASVAB 8 AFQT (raw score)	Percentile: Full sample (3,550 cases)	Percentile: Clean sample (3,001 cases)	Percentile: Clean sample with adjusted racial mix (2,546 cases)	Percentile: Smoothed percentiles from clean sample with adjusted racial mix
56	19.8	20.6	21.5	21
57	21.0	21.7	22.6	22
58	22.1	22.7	23.7	23
59	23.0	23.5	24.2	24
60	24.0	24.5	25.1	25
61	25.0	25.4	26.0	26
62	26.1	26.6	27.2	27
63	27.2	27.8	28.3	28
64	28.5	29.2	29.7	30
65	29.8	30.4	31.2	31
66	30.9	31.6	32.2	32
67	31.9	32.8	33.5	33
68	33.4	34.5	35.0	35
69	34.8	36.2	36.2	36
70	36.6	37.9	38.3	38
71	39.0	40.5	41.0	41
72	41.8	43.0	43.3	43
73	44.0	45.2	45.5	45
74	45.9	47.0	47.2	47
75	47.5	48.7	48.7	49
76	49.5	50.2	50.5	50
77	50.5	52.2	52.1	52
78	53.3	53.7	53.9	54
79	54.9	55.5	55.8	56
80	56.8	57.3	57.9	58
81	59.0	59.3	59.5	60
82	60.9	61.0	61.4	61
83	62.7	62.8	63.2	63
84	64.4	64.8	65.0	65
85	66.2	66.5	66.6	67
86	68.2	68.3	68.5	69
87	69.8	70.0	70.2	70
88	71.6	71.8	71.9	72
89	73.5	73.9	73.8	74
90	75.0	75.5	75.5	76

TABLE E-1 (Cont'd)

ASVAB 8 AFQT (raw score)	Percentile			
	Full sample (3,550 cases)	Clean sample (3,001 cases)	Clean sample with adjusted racial mix (2,546 cases)	Smoothed percentiles from clean sample with adjusted racial mix
91	76.9	77.4	77.2	77
92	78.7	78.8	78.8	79
93	80.3	80.4	80.2	80
94	81.8	82.0	82.1	82
95	83.4	83.5	83.3	83
96	84.9	85.0	85.0	85
97	85.2	86.4	86.4	86
98	87.9	87.8	88.0	88
99	89.1	89.3	89.7	90
100	90.4	91.0	91.0	91
101	91.6	92.3	92.0	92
102	92.8	93.7	93.4	93
103	94.0	95.0	95.0	95
104	97.0	97.0	97.0	97
105	99.0	99.0	99.0	99

APPENDIX F

EFFECT OF SAMPLE TRUNCATION

APPENDIX F

EFFECT OF SAMPLE TRUNCATION

All individuals in our sample had been previously tested at Armed Forces Examining and Entrance Stations (AFEES) and selected in accordance with the enlistment standards of each service. Because applicants who scored in the lower percentiles on the AFEES tests were rejected for enlistment, our sample contains fewer low-aptitude individuals than would a sample of AFEES applicants. In this appendix, we examine whether normalization results from such a truncated sample are biased.

The effect of preselection of recruits at AFEES on distributions of test scores of recruits is illustrated in figure F-1. Figure F-1(a) shows the distribution of scores on the operational ASVAB 6/7 AFQT expected from applicants at AFEES. Those applicants in the shaded area of figure F-1(a) were rejected for enlistment because of low test scores. Those in the unshaded area were accepted for enlistment and became recruits such as those who made up our data sample. Hence, a distribution of scores of recruits on a test administered at AFEES is said to be truncated due to direct selection on the test administered at AFEES. When these recruits were retested at reception centers, as was the case with the data used in our analysis, the distributions of retest scores were also distorted by the preselection at AFEES. The distortion of retest score distributions is illustrated in figures F-1(b) and F-1(c). The tests given at reception centers were highly correlated with the operational tests administered at AFEES. Hence, the removal of the shaded area in figure F-1(a) by rejecting low-aptitude applicants results in a similar, but less sharply defined, removal of low-aptitude cases in the shaded areas of figures F-1(b) and F-1(c). These cases were said to be removed by incidental selection. The unshaded areas in figures F-1(b) and F-1(c) represent the distributions used in our recruit sample to normalize ASVAB 8. If the incidental selection affected the distributions of scores on ASVAB 8 differently from those on the reference test, then our normalization of ASVAB 8 would be biased. If, on the other hand, the incidental selection affected both ASVAB 8 and the reference test equally, then the resulting normalization of ASVAB 8 would be unbiased. In this appendix, we examine the question of whether the unshaded areas of figures F-1(b) and F-1(c) produce unbiased normalization results.

Analogous to the unshaded illustrative distributions of figure F-1, are the test score distributions from our clean 3,001-case sample of recruits (figures F-2(a), F-2(b), and F-2(c)). Figure F-2(a) shows very few cases below the 30th percentile because service enlistment criteria reject most applicants below that level. The effects of incidental selection on ASVAB 8 AFQT raw

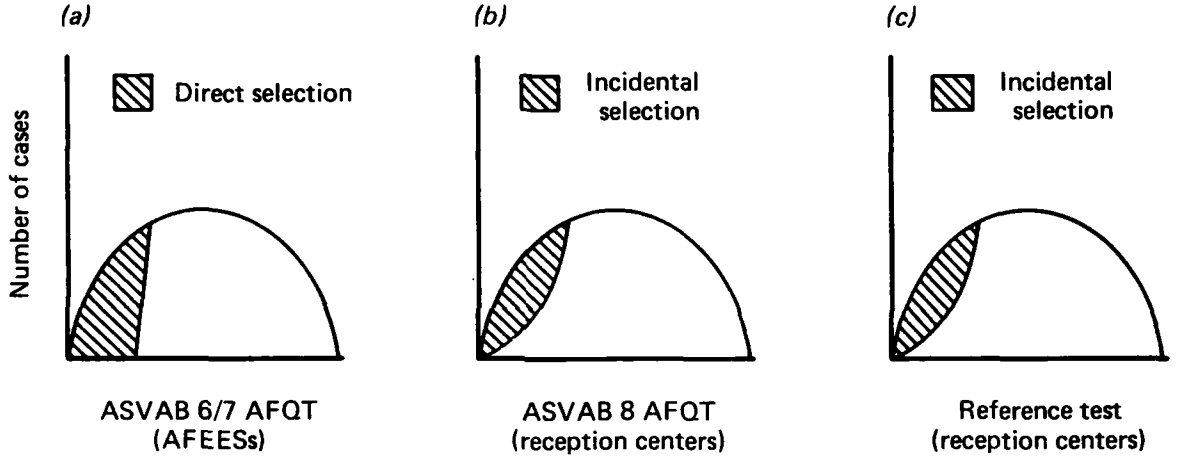
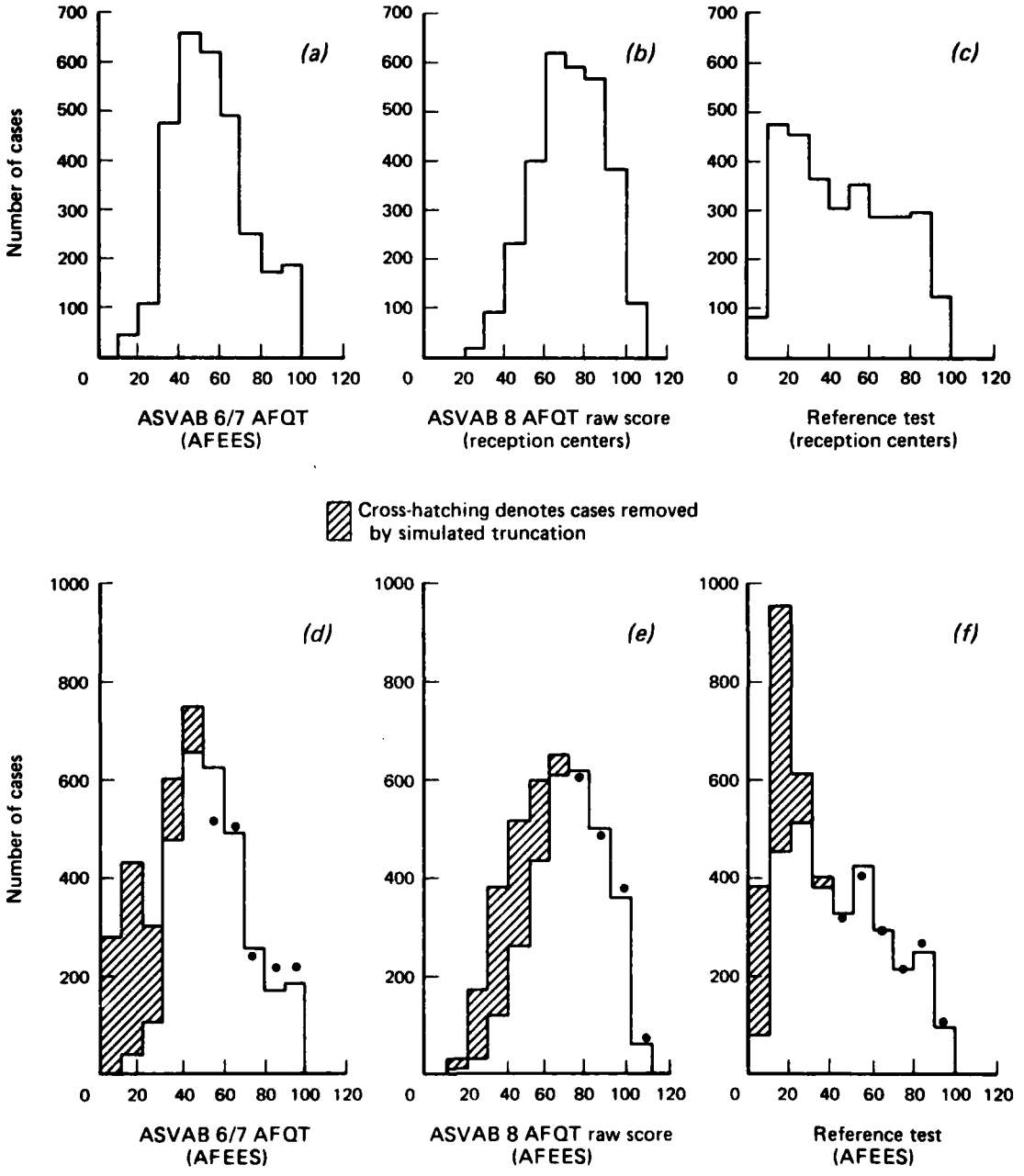


FIG. F-1: ILLUSTRATION OF DIRECT AND INCIDENTAL TEST SELECTION ON SAMPLE OF RECRUITS



Note: Full-range distribution (dots plus cross-hatched area) was scaled to the truncated distribution in the upper percentiles. Figures F-2 (a), (b), and (c) are from the CNA sample. Figures F-2 (d), (e), and (f) are from the ARI sample.

FIG. F-2: COMPARISON OF TRUNCATED CNA SAMPLE WITH FULL-RANGE AND TRUNCATED ARI SAMPLE

scores and reference test percentile scores are shown in figures F-2(b) and F-2(c).

To examine the effect of sample truncation on norming results, we used a full-range data sample. This sample was obtained from the Army Research Institute (ARI) and consisted of scores on ASVAB 6/7, ASVAB 8, and the reference test administered to applicants at AFEES. Because applicants, not recruits, were the test subjects for the ARI data set, it was not biased by truncation effects. We examined the truncation effect by first normalizing ASVAB 8 AFQT using the full-range ARI data sample, then truncating the ARI data sample and doing a second normalization of ASVAB 8 AFQT using the truncated ARI sample. Differences in the two normalization results are due to truncation effects. The truncation of the ARI sample is done in a way that closely simulates the actual truncation in our 3,001-case recruit sample. Note that we used the full-range ARI applicant sample only to determine if there was a truncation effect in our recruit sample. It was not used to construct a normalization.

The truncation effect was simulated in the full-range ARI sample by weighting the observed distribution in operational ASVAB 6/7 AFQT scores from the ARI sample to match those from the CNA sample. (The calculation is shown in table F-1.) The indicated weight factors were then applied to each case in the ARI full-range sample based on each individual's ASVAB 6/7 AFQT score. The resulting weighted distribution of ASVAB 6/7 AFQT scores from the ARI sample was almost identical to that of the CNA sample (see figures F-2(a) and F-2(d)). The unshaded areas of figures F-2(d), F-2(e), and F-2(f) are distributions from the ARI sample with truncation simulated by the weighting procedure. The shaded areas of figures F-2(d), F-2(e), and F-2(f) represent the difference between the full-range ARI sample and the same sample with simulated truncation. As such, the shaded areas represent applicants that would be rejected at AFEES as unqualified.

We used equipercentile equating, as shown in figures F-3 and F-4, to normalize ASVAB 8 AFQT in the ARI full-range and the ARI truncated sample. The results are tabulated in table F-2. The difference in the two normalizations is shown before and after smoothing.[1] The differences are generally very small and in all cases less than 1 percentile point. Only near the 4th and 20th percentile do the differences exceed the 0.5 percentile point. In our opinion, these differences are comparable to the uncertainties in the equating procedure itself and in any event are of no practical significance.

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[1]A 3-point moving average was used to smooth the difference.

TABLE F-1

CALCULATION OF WEIGHTS TO SIMULATE TRUNCATION

ASVAB 6/7 AFQT (percentiles) (1)	Operational AFEES data: CNA truncated sample (2)	Operational AFEES data: ARI full-range sample (3)	Weight factor[a] (4)
0- 9	0	151	0.000
10-19	41	233	0.176
20-29	106	161	0.658
30-39	477	322	1.481
40-49	658	401	1.641
50-59	623	286	2.178
60-69	489	269	1.818
70-79	254	127	2.000
80-89	168	117	1.436
90-99	185	119	1.555
Total	3,001	2,186	

[a]Column 2 divided by column 3.

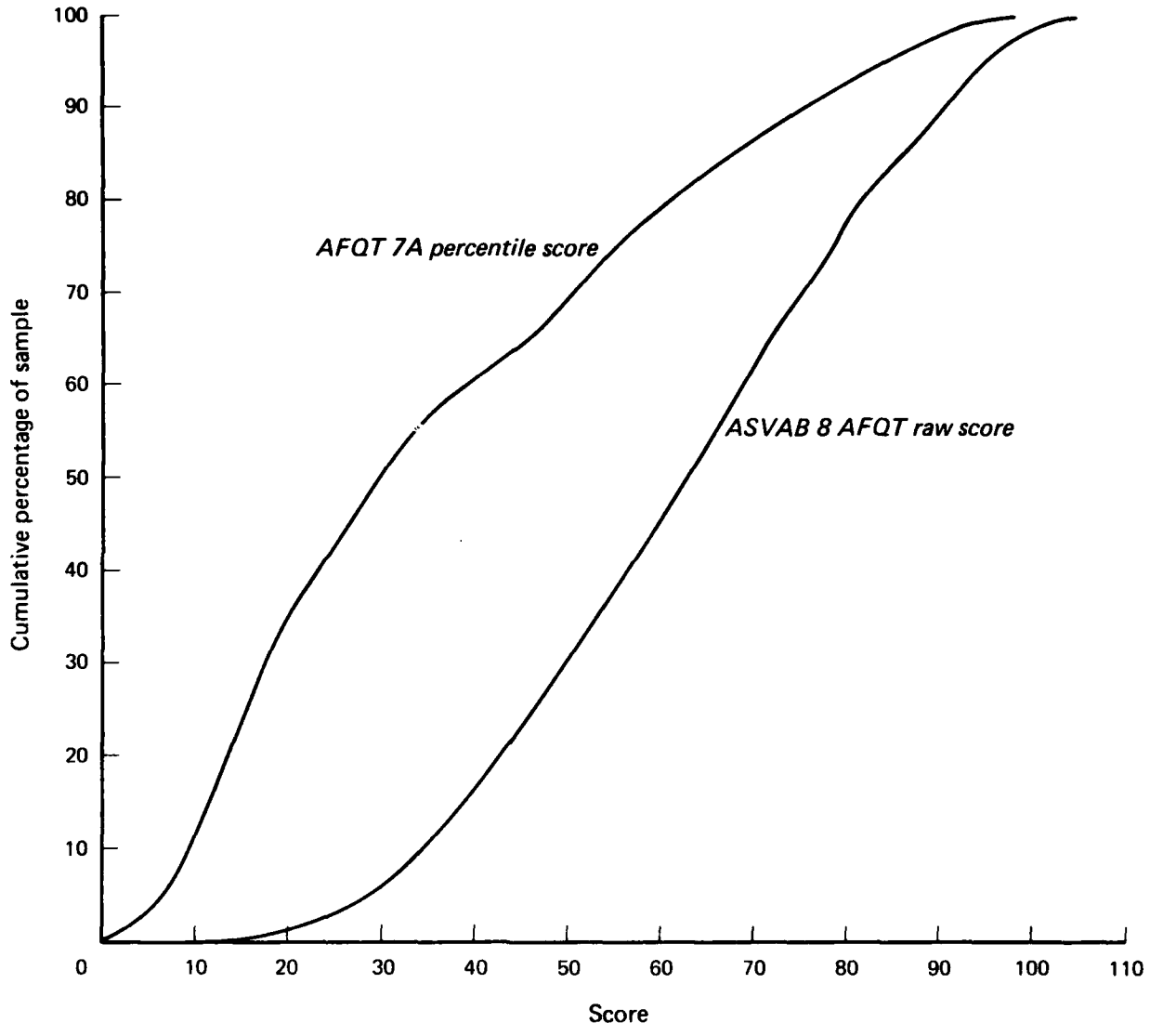

FIG. F-3: EQUIPERCENTILE EQUATING FOR ARI FULL-RANGE SAMPLE

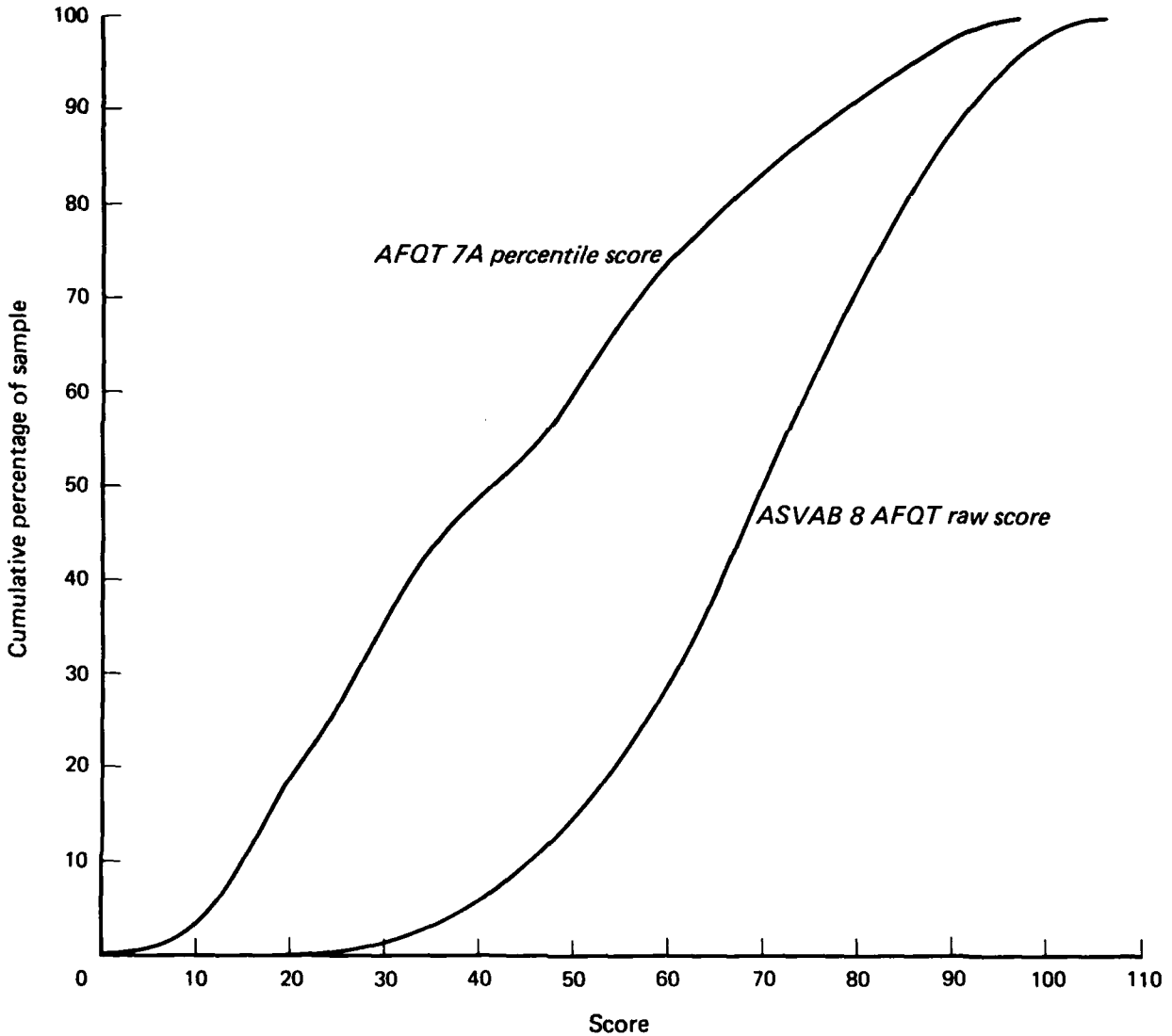

FIG. F-4: EQUIPERCENTILE EQUATING FOR ARI SAMPLE WITH SIMULATED TRUNCATION

TABLE F-2

COMPARISON OF EQUIPERCENTILE EQUATING RESULTS FROM ARI FULL-RANGE AND ARI TRUNCATED SAMPLE

ASVAB 8 AFQT (raw score)	Percentile score		Correction for truncation	
	Full-range (2,186 cases)	Truncated	Full-range minus truncated	Smoothed
15	0.0	0.0		
16	0.0	0.0		
17	0.0	0.0		
18	1.0	1.0	0.0	0.0
19	1.0	1.0	0.0	0.0
20	1.5	1.5	0.0	0.0
21	2.0	1.5	0.5	0.3
22	2.5	2.0	0.5	0.5
23	3.0	2.5	0.5	0.7
24	4.0	3.0	1.0	0.8
25	4.3	3.5	0.8	0.8
26	4.7	4.0	0.7	0.5
27	5.0	5.0	0.0	0.2
28	6.0	6.0	0.0	0.1
29	6.7	6.5	0.2	0.2
30	7.3	7.0	0.3	0.2
31	7.7	7.7	0.0	0.1
32	8.4	8.3	0.1	0.1
33	8.7	8.6	0.1	0.1
34	9.2	9.2	0.0	0.0
35	9.5	9.7	-0.2	-0.1
36	10.1	10.4	-0.3	-0.1
37	10.6	10.5	0.1	-0.1
38	11.0	11.1	-0.1	-0.1
39	11.4	11.6	-0.2	-0.1
40	12.2	12.2	0.0	-0.1
41	12.6	12.8	-0.2	-0.2
42	13.3	13.6	-0.3	-0.3
43	13.7	14.1	-0.4	-0.3
44	14.2	14.5	-0.3	-0.3
45	14.7	15.0	-0.3	-0.3
46	15.2	15.4	-0.2	-0.2
47	15.7	15.9	-0.2	-0.2
48	16.3	16.5	-0.2	-0.2
49	16.7	16.9	-0.2	-0.2
50	17.2	17.4	-0.2	-0.3
51	17.7	18.2	-0.5	-0.4
52	18.4	19.0	-0.6	-0.6
53	19.2	19.8	-0.6	-0.6
54	20.0	20.6	-0.6	-0.7

TABLE F-2 (Cont'd)

ASVAB 8 AFQT (raw score)	Percentile score		Correction for truncation	
	Full-range (2,186 cases)	Truncated	Full-range minus truncated	Smoothed
55	20.9	21.8	-0.9	-0.7
56	22.0	22.7	-0.7	-0.6
57	23.3	23.6	-0.3	-0.4
58	24.5	24.7	-0.2	-0.2
59	25.6	25.8	-0.2	-0.2
60	26.6	26.8	-0.2	-0.1
61	27.7	27.7	0.0	0.0
62	28.6	28.5	0.1	0.0
63	29.5	29.6	-0.1	0.0
64	30.7	30.8	-0.1	-0.2
65	31.8	32.1	-0.3	-0.3
66	33.0	33.4	-0.4	-0.4
67	34.5	35.0	-0.5	-0.4
68	36.8	37.2	-0.4	-0.4
69	39.3	39.7	-0.4	-0.4
70	41.9	42.4	-0.5	-0.4
71	44.2	44.6	-0.4	-0.4
72	46.3	46.5	-0.2	-0.3
73	47.8	48.0	-0.2	-0.2
74	48.9	49.1	-0.2	-0.1
75	50.3	50.3	0.0	-0.1
76	51.5	51.5	0.0	-0.1
77	52.5	52.8	-0.3	-0.1
78	54.3	54.2	0.1	0.0
79	56.1	55.7	0.3	0.2
80	57.7	57.5	0.2	0.2
81	60.2	60.0	0.2	0.2
82	62.2	62.0	0.2	0.0
83	63.6	64.0	-0.4	-0.1
84	65.4	65.5	-0.1	-0.1
85	67.0	66.7	0.3	0.1
86	68.4	68.4	0.0	0.1
87	70.0	70.0	0.0	0.0
88	71.4	71.5	-0.1	-0.2
89	73.0	73.4	-0.4	-0.5
90	74.3	75.2	-0.9	-0.6
91	76.0	76.5	-0.5	-0.8
92	78.0	79.0	-1.0	-0.8
93	79.6	80.4	-0.8	-0.7
94	82.0	82.2	-0.2	-0.3
95	84.3	84.2	0.1	0.0
96	86.0	86.0	0.0	0.3
97	88.0	87.3	0.7	0.5
98	89.4	88.8	0.6	0.6
99	90.4	90.0	0.4	0.5
100	91.5	91.0	0.5	0.2
101	92.2	92.5	-0.3	-0.1
102	93.5	94.0	-0.5	-0.3
103	96.0	96.0	0.0	-0.2
104	98.0	98.0	0.0	0.0
105	99.0	99.0	0.0	0.0

In table F-3, we show mean values and correlation coefficients for the variables relevant to the truncation issue. The similarity of the means and correlations observed in the CNA sample and in the truncated ARI sample indicate that the truncation-by-weighting procedure of the ARI data closely approximates the actual truncation in the CNA data. The correlations observed in the full-range ARI sample between the directly selected ASVAB 6/7 AFQT and each of the two indirectly selected tests are seen in table F-3 to be identical (0.85). This result indicates that distributions of both indirectly selected tests would have been distorted in a similar manner by preselection at AFEES and that we should not expect that a normalization based on retesting recruits should be biased.

We conclude that any bias in the ASVAB 8 AFQT normalization because of using a sample of recruits instead of applicants is negligible.

TABLE F-3

COMPARATIVE STATISTICS FOR TRUNCATED CNA SAMPLE AND ARI SAMPLE BEFORE AND AFTER SIMULATED TRUNCATION

Item	CNA sample (3,001 cases)	ARI sample (2,186 cases)	
		Truncated	Full-range
Mean values of:			
Directly selected[a] ASVAB 6/7 AFQT (percentile score)	55.2	55.2	46.2
Indirectly selected ASVAB 8 AFQT (raw score)	71.6	69.4	62.9
Indirectly selected reference test (percentile score)	45.8	44.2	37.3
Correlation coefficients between:			
Directly selected[a] ASVAB 6/7 AFQT and indirectly selected ASVAB 8 AFQT	0.78	0.79	0.85
Directly selected[a] ASVAB 6/7 AFQT and indirectly selected reference test	0.80	0.81	0.85
Indirectly selected ASVAB 8 AFQT and indirectly selected reference test	0.79	0.77	0.83

[a]This test was an operational test at AFEES; hence, distributions in ASVAB 6/7 scores made by successful applicants (i.e., recruits) do not contain those of low-aptitude applicants. These distributions may be said to be directly selected or truncated.

APPENDIX G

STRATIFICATION OF SAMPLE

APPENDIX G

STRATIFICATION OF SAMPLE

To build conversion tables for composites and subtests, we stratified our sample on the reference test AFQT 7A. By applying the weight factors calculated in table G-1, we were able to simulate the traditional reference population.

TABLE G-1

CALCULATION OF WEIGHT FACTORS FOR BUILDING COMPOSITES AND SUBTESTS

AFQT 7A percentile interval (1)	Number observed in sample (2)	Number expected in mobilization population (3)	Weight factor[a] (4)
0- 9	96	300.1	3.126
10-19	497	300.1	0.604
20-29	430	300.1	0.698
30-39	418	300.1	0.718
40-49	300	300.1	1.000
50-59	354	300.1	0.848
60-69	293	300.1	1.024
70-79	256	300.1	1.172
80-89	267	300.1	1.124
90-99	90	300.1	3.334
Total	3,001		

[a]Column 3 divided by column 2.

APPENDIX H

CONVERSION TABLES FOR SUBTESTS

APPENDIX H

CONVERSION TABLES FOR SUBTESTS

To build conversion tables for ASVAB 8 subtests, we stratified the sample on the reference test AFQT 7A, as described in appendix G. The mean value and standard deviation of each subtest were obtained. Standard scores were calculated for each subtest raw score using the equation

$$\text{ASVAB Standard Score } (X_i) = 50 + 10\,\frac{(X_i - \overline{X})}{\sigma_x},$$

where

X_i = is the i^{th} raw score of subtest X,

$\overline{X}$ = is the mean raw score of subtest X,

σ_x = is the standard deviation of subtest X.

The resultant conversion tables are listed in table H-1.

TABLE H-1

ASVAB 8 SUBTEST CONVERSION TABLES
(expressed in ASVAB Standard Score)

Raw score	Paragraph Comprehension (PC)	Mathematics Knowledge (MK)	Mechanical Comprehension (MC)	Electronics Information (EI)	Raw score
25	-	71	67	-	25
24		70	65		24
23		68	63		23
22		66	61		22
21		64	59		21
20	-	63	58	67	20
19		61	56	65	19
18		60	54	62	18
17		58	52	60	17
16		56	50	58	16
15	63	54	48	55	15
14	60	52	47	53	14
13	57	51	44	51	13
12	54	49	43	48	12
11	51	47	41	46	11
10	48	46	39	44	10
9	45	44	37	41	9
8	42	42	35	39	8
7	39	41	33	36	7
6	36	39	31	34	6
5	33	37	29	32	5
4	30	35	28	29	4
3	27	34	26	27	3
2	25	32	24	25	2
1	22	30	22	22	1
0	19	29	20	20	0

TABLE H-1 (Cont'd)

Raw score	General Science (GS)	Arithmetic Reasoning (AR)	Word Knowledge (WK)	Auto & Shop Information (AS)	Raw score
35	-	-	63	-	35
34			61		34
33			60		33
32			58		32
31			57		31
30	-	67	56	-	30
29		65	54		29
28		64	53		28
27		63	51		27
26		61	50		26
25	68	60	48	65	25
24	66	58	47	63	24
23	64	57	46	61	23
22	62	56	44	59	22
21	59	54	43	58	21
20	57	53	41	56	20
19	55	51	40	54	19
18	53	50	39	52	18
17	51	49	37	50	17
16	49	47	36	48	16
15	47	46	34	46	15
14	45	44	33	44	14
13	43	43	31	42	13
12	40	42	30	40	12
11	38	40	29	38	11
10	36	39	27	37	10
9	34	37	26	35	9
8	32	36	24	33	8
7	30	35	23	31	7
6	28	33	22	29	6
5	26	32	20	27	5
4	24	31	19	25	4
3	21	29	17	23	3
2	19	28	16	21	2
1	17	26	14	19	1
0	15	25	13	17	0

TABLE H-1 (Cont'd)

Raw score	Numerical Operations (NO)	Coding Speed (CS)	Verbal (VE)	Raw score
84	-	75	-	84
83		75		83
82		74		82
81		74		81
80	-	73	-	80
79		72		79
78		72		78
77		71		77
76		70		76
75	-	70	-	75
74		69		74
73		68		73
72		68		72
71		67		71
70	-	66	-	70
69		66		69
68		65		68
67		65		67
66		64		66
65	-	63	-	65
64		63		64
63		62		63
62		61		62
61		61		61
60	-	60	-	60
59		59		59
58		59		58
57		58		57
56		57		56
55	-	57	-	55
54		56		54
53		56		53
52		55		52
51		54		51
50	63	54	63	50
49	62	53	62	49
48	61	52	61	48
47	60	52	60	47
46	59	51	59	46
45	58	50	58	45
44	57	50	57	44
43	56	49	56	43
42	55	48	55	42
41	54	48	54	41

TABLE H-1 (Cont'd)

Raw score	Numerical Operations (NO)	Coding Speed (CS)	Verbal (VE)	Raw score
40	53	47	53	40
39	52	47	52	39
38	51	46	51	38
37	50	45	50	37
36	49	45	49	36
35	48	44	48	35
34	47	43	47	34
33	46	43	46	33
32	45	42	45	32
31	44	41	44	31
30	43	41	43	30
29	42	40	42	29
28	41	39	41	28
27	40	39	40	27
26	39	38	39	26
25	38	38	38	25
24	37	37	37	24
23	36	36	36	23
22	35	36	35	22
21	34	35	34	21
20	33	34	33	20
19	32	34	32	19
18	31	33	31	18
17	30	32	30	17
16	29	31	29	16
15	28	31	28	15
14	27	30	27	14
13	26	30	26	13
12	25	29	25	12
11	24	29	24	11
10	23	28	23	10
9	22	27	22	9
8	21	27	21	8
7	20	26	20	7
6	19	25	19	6
5	18	25	18	5
4	17	24	17	4
3	16	23	16	3
2	15	23	15	2
1	14	22	14	1
0	13	21	13	0

APPENDIX I

EQUIPERCENTILE EQUATING FOR COMPOSITES

APPENDIX I

EQUIPERCENTILE EQUATING FOR COMPOSITES

The equipercentile equating method was used to equate composite scores to percentile scores or to standard scores on the reference test AFQT 7A. The equating methodology is described in reference I-1. Composites were built from sums of ASVAB 8 subtests in ASVAB Standard Score form.[1] For a definition of composites, see appendix A.

For the Army and Marine Corps composites, which must be expressed in Army Standard Score form, the percentile scores made by each recruit on the reference test AFQT 7A were first converted to equivalent Army Standard Scores[2] using traditional relations (tabulated in table I-1). The sums of ASVAB 8 subtests in ASVAB Standard Score form were then directly equated[3] to the AFQT 7A scores expressed in Army Standard Score form. For the Air Force Composites, which were expressed in percentiles, the sums of ASVAB 8 subtests in ASVAB Standard Score form were directly equated to AFQT 7A scores expressed in percentiles.

Composite conversion tables are tabulated in appendix J.

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[1] ASVAB Standard Scores have mean values of 50 and a standard deviation of 10.

[2] Army Standard Scores have mean values of 100 and a standard deviation of 20.

[3] To minimize bias from sample stratification we performed the equating using unstratified data.

TABLE I-1

TRADITIONAL CONVERSION TABLE: AFQT 1 OR AFQT 2
PERCENTILE SCORES TO ARMY STANDARD SCORES

Percentile	Standard score	Percentile	Standard score
100	164	28	86
100	157	27	85
100	151	26	84
100	146	24	83
99	142	23	82
98	139	22	81
97	137	21	80
96	134	20	79
95	131	19	78
93	130	18	77
92	128	17	76
90	126	16	75
89	125	15	73
87	123	14	71
85	122	13	70
84	121	12	69
82	120	12	68
80	118	11	66
78	117	10	65
76	116	9	64
74	115	9	63
73	114	8	62
71	113	7	61
69	112	7	60
67	111	6	59
65	110	5	57
63	109	5	56
61	107	4	55
59	106	4	53
57	105	3	52
55	104	3	50
53	103	2	48
51	101	2	47
49	100	2	45
47	99	2	43
45	98	2	42
43	97	2	42
41	96	1	41
39	95	1	41
37	94	1	40
36	93	1	39
34	92	1	39
32	91	1	39
31	90	1	39
30	88	1	39

REFERENCE

I-1 Robert L. Thorndike, "Educational Measurement," American Council on Education, Washington, D.C., Unclassified, 1971

APPENDIX J

CONVERSION TABLES FOR COMPOSITES

APPENDIX J

CONVERSION TABLES FOR COMPOSITES

The conversion tables for ASVAB 8 composites were built using the equipercentile equating method.[1] The Army and Marine Corps conversion tables are in Army Standard Scores (table J-1). The Air Force conversion tables are in percentile scores (table J-2). See appendix A for definitions of composites.

For Navy recruits, only subtest scores in ASVAB Standard Score form are reported by AFEES. Classification composites built from these subtest scores are constructed by Navy testing and classification personnel and are not a subject of this report.

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[1]The sample was not stratified before equating.

TABLE J-1

CONVERSION TABLE FOR ARMY AND USMC COMPOSITES
(Army Standard Scores)

Sum of subtest scores in ASVAB Standard Score form	GT	CL	Marine Corps CO	Marine Corps FA	Sum of subtest scores in ASVAB Standard Score form
201	--	140	--	--	201
200		140			200
199		139			199
198		138			198
197		137			197
196		136			196
195	--	134	--	140	195
194		133		140	194
193		132		140	193
192		131		139	192
191		131	140	137	191
190	--	130	140	134	190
189		130	140	132	189
188		129	139	131	188
187		128	138	130	187
186		128	136	129	186
185	--	127	134	128	185
184		127	132	127	184
183		126	130	126	183
182		125	129	125	182
181		124	128	124	181
180	--	123	127	123	180
179		122	126	122	179
178		122	125	121	178
177		121	124	121	177
176		120	123	120	176
175	--	120	122	119	175
174		119	121	118	174
173		118	120	117	173
172		117	119	116	172
171		116	118	115	171

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GT	CL	Marine Corps CO	Marine Corps FA	Sum of subtest scores in ASVAB Standard Score form
170	--	115	117	115	170
169		114	116	114	169
168		113	115	113	168
167		113	114	112	167
166		112	113	112	166
165	--	111	112	111	165
164		110	111	110	164
163		109	110	109	163
162		109	109	109	162
161		108	108	108	161
160	--	107	107	107	160
159		106	106	106	159
158		105	105	105	158
157		104	104	105	157
156		103	103	104	156
155	--	102	102	103	155
154		101	101	102	154
153		101	100	101	153
152		100	100	101	152
151		100	99	100	151
150	--	99	98	99	150
149		98	97	99	149
148		97	96	98	148
147		96	95	97	147
146		95	94	96	146
145	--	94	93	95	145
144		93	93	94	144
143		93	92	94	143
142		92	91	93	142
141		91	90	92	141

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GT	CL	Marine Corps CO	Marine Corps FA	Sum of subtest scores in ASVAB Standard Score form
140	--	90	89	92	140
139		89	88	91	139
138		88	87	90	138
137		87	86	89	137
136		86	86	88	136
135	--	85	85	87	135
134		85	84	86	134
133		84	84	85	133
132		84	83	85	132
131		83	82	84	131
130	140	82	82	84	130
129	139	81	81	83	129
128	138	81	81	82	128
127	131	80	80	82	127
126	129	79	79	81	126
125	127	79	79	80	125
124	125	78	78	80	124
123	124	78	78	79	123
122	122	77	77	79	122
121	121	77	76	78	121
120	120	76	75	78	120
119	119	75	75	77	119
118	118	75	74	77	118
117	117	74	74	76	117
116	116	74	73	75	116
115	115	73	73	75	115
114	114	72	72	74	114
113	113	72	72	74	113
112	112	71	71	73	112
111	111	71	71	72	111

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GT	CL	Marine Corps CO	Marine Corps FA	Sum of subtest scores in ASVAB Standard Score form
110	110	70	71	72	110
109	109	70	70	71	109
108	108	70	70	71	108
107	107	69	69	70	107
106	106	68	69	70	106
105	105	68	68	69	105
104	104	67	67	68	104
103	103	66	67	67	103
102	102	66	66	66	102
101	101	66	66	65	101
100	100	65	65	64	100
99	99	64	65	63	99
98	97	64	64	63	98
97	96	63	64	62	97
96	95	63	63	62	96
95	94	62	63	61	95
94	93	62	62	60	94
93	92	61	62	59	93
92	91	61	61	58	92
91	90	60	60	57	91
90	89	59	59	56	90
89	87	58	58	55	89
88	86	57	57	55	88
87	85	57	57	55	87
86	84	56	55	55	86
85	83	56	55	55	85
84	82	55	55	55	84
83	81	55	55	55	83
82	81	55	55	55	82
81	80	55	55	55	81

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GT	CL	Marine Corps CO	Marine Corps FA	Sum of subtest scores in ASVAB Standard Score form
80	79	55	55	55	80
79	78	55	55	55	79
78	77	55	55	55	78
77	76	55	55	55	77
76	75	55	55	55	76
75	74	55	55	55	75
74	73	55	55	55	74
73	72	55	55	55	73
72	71	55	55	55	72
71	70	55	55	55	71
70	69	55	55	55	70
69	68	55	55	55	69
68	67	55	55	55	68
67	66	55	55	55	67
66	65	55	55	55	66
65	64	55	55	--	65
64	62	55	55		64
63	61	55	55		63
62	59	55	55		62
61	57	55	55		61
45-60	55	--	--	--	45-60

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
274-280	--	--	--	--	140	140	--	--	--	274
273					140	139				273
272		140			140	139				272
271		140			140	138				271
270	140	140	--	--	140	138	--	--	--	270
269	140	140			140	137				269
268	140	139			140	136		140		268
267	140	138			140	135		140		267
266	140	136		140	140	134		140	140	266
265	140	134	--	140	139	133	--	139	140	265
264	139	132		140	139	132		138	140	264
263	138	131		140	138	132		137	140	263
262	136	131	140	140	138	131		136	140	262
261	135	130	140	140	137	131		134	139	261
260	133	130	140	140	137	130	--	132	138	260
259	132	129	140	140	136	130		131	137	259
258	131	129	140	140	135	130	140	131	136	258
257	130	128	140	139	134	129	140	130	135	257
256	130	128	140	138	134	129	140	130	134	256
255	129	127	139	137	133	128	140	129	132	255
254	129	127	138	136	132	128	140	128	131	254
253	128	126	136	135	131	128	140	128	131	253
252	128	126	134	134	131	127	139	127	130	252
251	127	125	133	133	130	127	138	126	129	251

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
250	127	125	132	132	130	126	136	126	128	250
249	127	125	131	131	129	126	134	125	128	249
248	126	124	130	131	129	125	133	125	127	248
247	126	124	129	130	128	125	131	125	127	247
246	125	123	129	130	128	124	130	124	126	246
245	125	123	128	129	127	124	130	124	125	245
244	124	122	128	128	127	123	129	123	125	244
243	124	122	127	128	126	123	128	123	124	243
242	123	122	126	127	126	123	127	122	123	242
241	123	121	126	127	125	122	127	122	123	241
240	122	121	126	126	124	122	126	122	122	240
239	122	121	125	126	124	122	125	121	122	239
238	122	120	124	125	123	121	125	121	121	238
237	121	120	123	124	123	121	124	120	121	237
236	121	119	123	124	122	120	124	120	120	236
235	120	119	122	123	122	120	123	120	120	235
234	120	118	122	123	121	119	123	119	119	234
233	119	118	121	122	120	119	122	119	119	233
232	119	117	120	121	120	118	121	118	118	232
231	118	117	119	121	119	118	121	118	118	231
230	118	117	119	120	118	117	120	117	117	230
229	117	116	119	119	118	117	119	117	117	229
228	117	116	118	119	117	116	119	116	116	228
227	116	115	117	118	116	116	118	116	115	227
226	116	115	117	117	116	115	117	115	114	226

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
225	115	114	116	116	115	115	116	115	114	225
224	114	114	115	116	114	114	115	114	113	224
223	114	114	114	115	114	114	114	114	113	223
222	113	113	114	114	113	113	114	113	112	222
221	113	113	113	113	113	113	113	113	112	221
220	112	112	113	112	112	112	112	112	111	220
219	112	112	112	112	112	112	112	112	111	219
218	111	112	111	111	111	112	111	111	110	218
217	111	111	111	111	111	111	110	111	110	217
216	110	111	110	110	110	111	110	110	109	216
215	109	110	110	109	109	110	109	109	109	215
214	109	109	109	108	109	110	108	109	108	214
213	108	109	108	108	108	109	108	108	108	213
212	108	108	107	107	107	109	107	108	107	212
211	107	108	107	106	107	108	106	107	106	211
210	106	107	106	105	106	108	105	106	106	210
209	106	107	105	104	105	107	105	106	105	209
208	105	106	105	104	105	107	104	105	105	208
207	105	106	104	103	104	106	103	105	104	207
206	105	105	103	102	104	105	102	104	104	206
205	104	104	102	101	103	105	102	103	103	205
204	103	104	102	101	102	104	101	103	102	204
203	102	103	101	100	102	103	100	102	102	203
202	102	103	101	100	101	103	100	102	101	202
201	101	102	100	99	101	102	99	101	101	201

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
200	101	102	99	98	100	102	98	101	100	200
199	100	101	99	97	100	101	98	100	100	199
198	100	101	98	97	99	101	97	100	99	198
197	99	100	97	96	99	100	96	99	99	197
196	99	100	97	95	98	100	96	99	98	196
195	98	100	96	95	97	99	95	98	98	195
194	97	99	95	94	96	99	94	98	97	194
193	96	99	95	94	96	98	94	97	96	193
192	96	98	94	93	95	97	93	96	95	192
191	95	97	94	92	95	96	93	96	95	191
190	95	97	93	92	94	96	92	95	94	190
189	94	96	93	91	94	95	92	95	94	189
188	94	95	92	90	93	95	91	94	93	188
187	93	95	92	89	92	94	90	94	93	187
186	93	94	91	88	92	94	90	93	92	186
185	92	94	90	88	91	93	89	93	92	185
184	91	93	90	87	90	93	88	92	91	184
183	90	92	89	86	89	92	88	91	91	183
182	90	92	88	86	88	91	87	91	90	182
181	89	91	88	85	87	90	87	90	89	181
180	88	90	87	85	87	89	86	89	88	180
179	88	90	86	84	86	89	85	88	88	179
178	87	89	85	84	86	88	85	87	87	178
177	86	88	84	83	85	87	84	86	87	177
176	86	87	84	83	85	86	84	86	86	176

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TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
175	85	87	84	82	84	86	83	85	86	175
174	85	86	83	82	84	85	83	84	85	174
173	84	85	83	81	83	84	82	84	85	173
172	84	85	82	81	83	84	82	83	84	172
171	83	84	82	80	82	83	81	83	84	171
170	83	84	81	79	82	82	81	82	83	170
169	82	83	81	79	81	82	80	82	83	169
168	82	82	80	79	81	81	80	81	82	168
167	81	82	80	78	80	80	79	81	82	167
166	81	81	79	78	79	80	79	80	82	166
165	80	81	79	77	79	79	78	80	81	165
164	80	80	78	77	78	79	78	79	81	164
163	79	79	78	76	78	78	78	79	80	163
162	79	79	78	76	77	78	77	78	80	162
161	78	78	77	75	77	77	77	78	79	161
160	78	77	77	75	76	76	76	77	79	160
159	77	77	76	74	76	76	76	77	78	169
158	77	76	76	74	75	75	75	77	78	158
157	76	76	75	73	74	74	75	76	77	157
156	75	75	74	73	74	73	74	76	77	156
155	75	74	74	73	73	73	74	75	76	155
154	74	74	73	72	73	72	73	74	76	154
153	74	73	73	72	72	71	73	74	75	153
152	73	73	72	71	72	71	72	73	74	152
151	72	72	72	71	71	70	72	73	74	151

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
150	72	71	71	71	71	70	72	72	73	150
149	72	71	71	70	71	69	71	72	73	149
148	71	70	71	70	70	68	71	71	72	148
147	71	69	70	69	70	67	71	71	72	147
146	70	69	70	69	69	66	70	70	71	146
145	70	68	69	68	68	66	70	70	71	145
144	70	67	69	68	68	65	69	69	71	144
143	69	66	68	68	67	65	69	68	70	143
142	68	66	67	67	66	64	68	68	69	142
141	67	65	67	67	66	64	68	67	68	141
140	66	64	66	67	66	63	67	66	68	140
139	66	63	66	66	65	63	67	66	67	139
138	65	63	65	66	64	62	66	65	66	138
137	65	62	65	66	64	62	66	65	66	137
136	64	62	64	65	63	61	65	64	65	136
135	63	61	64	65	63	60	64	64	64	135
134	63	60	64	64	62	59	64	63	63	134
133	62	59	63	64	62	58	63	62	63	133
132	61	58	63	63	61	57	63	61	62	132
131	60	56	62	63	61	57	63	60	62	131
130	59	55	62	62	60	56	63	60	61	130
129	59	55	61	62	60	55	62	59	60	129
128	58	55	61	62	59	55	62	58	59	128
127	57	55	60	61	58	55	61	57	58	127
126	56	55	60	61	57	55	60	56	57	126

TABLE J-1 (Cont'd)

Sum of subtest scores in ASVAB Standard Score form	GM	EL	Army MM	SC	Army CO	Army FA	OF	ST	Marine Corps MM	Sum of subtest scores in ASVAB Standard Score form
125	55	55	59	60	56	55	60	55	56	125
124	55	55	58	60	55	55	59	55	55	124
123	55	55	57	59	55	55	58	55	55	123
122	55	55	56	59	55	55	57	55	55	122
121	55	55	56	58	55	55	56	55	55	121
120	55	55	55	57	55	55	55	55	55	120
119	55	55	55	56	55	55	55	55	55	119
83-118	55	55	55	55	55	55	55	55	55	83-118

TABLE J-2

CONVERSION TABLE FOR AIR FORCE COMPOSITES

Mechanical aptitude index		Administrative aptitude index		General aptitude index		Electronic aptitude index	
Raw score	AI	Raw score	AI	Raw score	AI	Raw score	AI
255 & above	95	192 & above	95	127 & above	95	262 & above	95
248-254	90	183-191	90	125-126	90	253-261	90
241-247	85	179-182	85	122-124	85	244-252	85
234-240	80	173-178	80	118-121	80	233-243	80
230-233	75	171-172	75	116-117	75	229-232	75
223-229	70	167-170	70	112-115	70	220-228	70
219-222	65	163-166	65	110-111	65	215-219	65
212-218	60	159-162	60	106-109	60	208-214	60
209-211	55	157-158	55	104-105	55	205-207	55
204-208	50	154-156	50	101-103	50	199-204	50
197-203	45	149-153	45	98-100	45	192-198	45
194-196	40	147-148	40	96-97	40	189-191	40
189-193	35	144-146	35	94-95	35	184-188	35
181-188	30	138-143	30	90-93	30	177-183	30
170-180	25	132-137	25	85-89	25	169-176	25
161-169	20	126-131	20	80-84	20	163-168	20
147-160	15	115-125	15	74-79	15	153-162	15
130-146	10	100-114	10	66-73	10	141-152	10
119-129	5	88-99	5	61-65	5	132-140	5
118 & below	01	87 & below	01	60 & below	01	131 & below	01

APPENDIX K

SAMPLE STATISTICS

APPENDIX K

SAMPLE STATISTICS

From our sample stratified on AFQT 7A percentile scores in appendix G, we calculated mean values, standard deviations, and correlation coefficients of ASVAB subtests and composites. Statistics for the subtests are shown in tables K-1 and K-2. Correlation coefficients for the composites are shown in table K-3.

TABLE K-1

MEAN VALUES AND STANDARD DEVIATIONS OF ASVAB 8 SUBTESTS

Variable[a]	Mean value	Standard deviation
GS	16.54	4.73
AR	17.96	7.16
WK	26.09	7.05
PC	10.61	3.38
NO	37.10	10.00
CS	44.38	15.57
AS	17.04	5.23
MK	12.55	5.87
MC	15.95	5.33
EI	12.75	4.24
VE	36.69	9.89
AFQT 7A	50.43	28.23
AFQT 8	73.43	19.09

[a]See tables A-1 and A-2 for definitions.

TABLE K-2

CORRELATION COEFFICIENTS[a] OF ASVAB SUBTESTS[b]

	GS	AR	WK	PC	NO	CS	AS	MK	MC	EI	VE	AFQT 7A	AFQT 8
GS	-	68	78	68	40	37	65	64	68	74	79	75	77
AR	68	-	67	69	55	51	57	80	67	64	72	83	89
WK	78	67	-	77	46	46	63	61	62	72	98	76	88
PC	68	69	77	-	50	49	57	61	60	65	89	72	85
NO	40	55	46	50	-	64	31	55	36	36	50	48	73
CS	37	51	46	49	64	-	33	49	38	38	49	47	61
AS	65	57	63	57	31	33	-	47	72	72	64	71	63
MK	64	80	61	61	55	49	47	-	61	58	65	72	78
MC	68	67	62	60	36	38	72	61	-	71	65	78	68
EI	74	64	72	65	36	38	72	58	71	-	73	75	71
VE	79	72	98	89	50	49	64	65	65	73	-	79	92
AFQT 7A	75	83	76	72	48	47	71	72	78	75	79	-	86
AFQT 8	77	89	88	85	73	61	63	78	68	71	92	86	-

[a] Decimal points omitted.

[b] See appendix A for definitions.

TABLE K-3

CORRELATION COEFFICIENTS[a] OF ASVAB COMPOSITES[b]

	GT	GM	EL	CL	ARMY MM	ARMY SC	ARMY CO	ARMY FA	ARMY OF	ARMY ST	USMC MM	USMC CO	USMC FA	USAF M	USAF A	USAF G	USAF E
GT	-	87	93	81	83	86	88	90	89	93	87	88	96	85	81	100	93
GM	87	-	96	70	93	83	90	86	91	95	95	88	93	95	70	87	96
EL	93	96	-	74	88	81	89	92	87	96	92	84	92	86	74	93	100
CL	81	70	74	-	78	96	82	84	84	76	68	89	77	68	100	81	74
ARMY MM	83	93	88	78	-	89	94	86	97	89	96	93	91	91	78	83	88
ARMY SC	86	83	81	96	89	-	91	88	94	84	82	97	88	84	96	86	81
ARMY CO	88	90	89	82	94	91	-	95	94	90	95	89	93	88	82	88	89
ARMY FA	90	86	92	84	86	88	95	-	88	91	88	83	87	77	84	90	92
ARMY OF	89	91	87	84	97	94	94	88	-	92	93	98	95	93	84	88	87
ARMY ST	93	95	96	76	89	84	90	91	92	-	92	87	93	90	76	93	96
USMC MM	87	95	92	68	96	82	95	88	93	92	-	87	95	93	68	87	92
USMC CO	88	88	84	89	93	97	89	83	98	87	87	-	93	91	89	88	84
USMC FA	96	93	92	77	91	88	93	87	95	93	95	93	-	95	77	96	92
USAF M	85	95	86	68	91	84	88	77	93	90	93	91	95	-	68	85	86
USAF A	81	70	74	100	78	96	82	84	84	76	68	89	77	68	-	81	74
USAF G	100	87	93	81	83	86	88	90	88	93	87	88	96	85	81	-	93
USAF E	93	96	100	74	88	81	89	92	87	96	92	84	92	86	74	93	-

[a]Decimal points omitted.
[b]See appendix A for definitions.


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